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## Lock Joint Head Stamping—How to Make it and the Tools for It.—II.

BY W. A. WARMAN AND THOS. A. DICKS.

Having gotten our stamping ready for closing into shape, the next operation is to push the piece through the closing die, Figs. 12 and 13. Fig. 13 shows the work in place, with the loose mandrel which pushes through with the stamping, and Fig. 14 is a side view of the loose mandrel and the punch. The loose mandrel *B*, Fig. 13, has rectangular ends fitting the grooves in the die. The punch *A* has its sides planed to fit these grooves. The punch is cut away in the center, sufficiently to allow the ends of stamping to close around the mandrel.

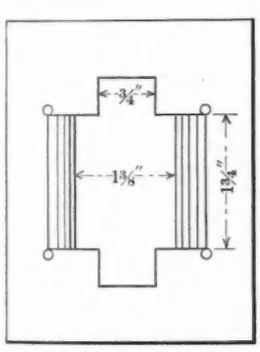


Fig. 12

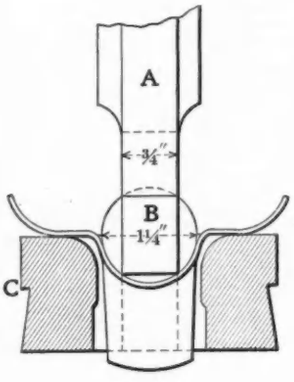


Fig. 13

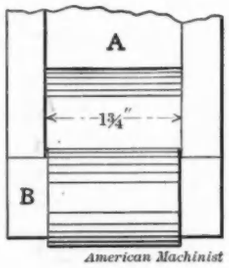


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Fig. 14

FORMING DIE AND PUNCH.

The die, Fig. 12, should be hardened by the method given for dies 1, 2 and 3, and don't forget to polish well. This die must not fit tight enough to stretch or draw the metal; yet it should fit snugly.

We then place the work on a mandrel and strike a blow in the drop dies shown in Figs. 21 and 22. This last operation sets the metal and brings the joint together nicely. See Fig 6 A. Although the drop is nearly an extinct species in cycle stamping shops, we still think there are a few jobs that can be done best with a drop. These dies are made with a hole through to fit the mandrel, and are recessed to fit the stamping. The hole on the angle in the bottom die may be made so as to accommodate several angles.

We now come to the final operation—punching and driving in the locking pieces. This is done by placing the piece in the clamping block *C*, Figs. 16 and 17, and pushing onto the mandrel die *L*, clamping tight in the vise *B* by means of the coarse-pitch screw *D*.

After punching, the screw is slackened, the vise pulled forward, and, without removing the work, the block *C* is placed in the other end of the vise, put on the mandrel *N*, and clamped as before. Then insert a piece of metal (curved as shown in Fig. 20) between the die *F* and the stripper *G*, Fig. 16, touch your treadle, and there you are—the locking pieces are cut out and inserted in place.

The metal for making the locking pieces is most convenient to handle in the size shown in Fig. 20, as such a piece makes two sets of locking pieces by pushing to the stop indicated by the dotted line (Fig. 17) and reversing for the next cut. Thus, there is practically no waste, and they are simple and easy to form.

This set of combination dies for punching and locking requires the greatest care in its construction. The block *A* must first be planed perfectly true. The vise casting is then planed, and a piece of steel ¼ inch thick, to cover the entire back of the vise, securely fastened with countersunk screws. The clamping blocks *C C* are now fitted and clamped in place by one of the screws *D*. The block *A* and vise *B* are now clamped together on an angle plate on the face plate for boring. *B* may be secured to *A* by a couple of small dowels through the thin plate. Center the work with the joint in *C C*. Bore a 1¼-inch hole clear through *C C*, *B* and *A*. The clamping block may then be recessed as shown in Fig. 18. Remove the block *C C* and clamp in the other end of vise; shift *A*, *B* and *C C* on the angle plate to bring the hole in *C C* again central.

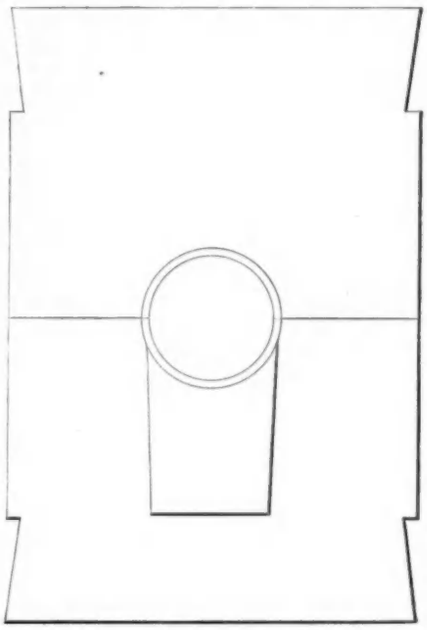

Fig. 21

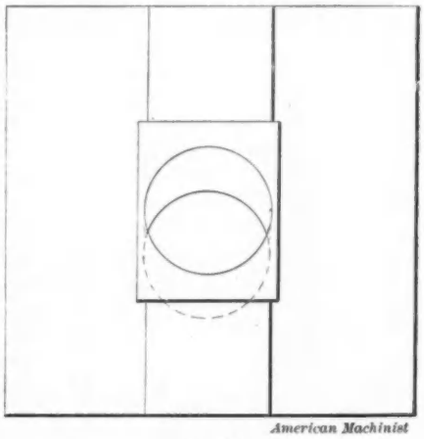

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Fig. 22

DROP DIES.

Remove *C C* and bore the second 1¼-inch hole through *A*. In setting the angle plate for this job, set it exactly parallel to a center line drawn across the face plate.

It will be well to have two pairs of these clamping blocks *C C;* and before shifting to bore the second hole, the second pair may be put in and bored. Two pairs will enable two operators to work on a press, one pair being emptied and filled while the other is in the press.

Next make the two tool-steel mandrels *I.* and *N*, securing *L* with a set screw. Shape out *L*, and fit in dovetailed piece shown in sketch. Now make the die *F* and stripper *G* (do not plane out the circular parts), locate *F*, *G* central with *N*, lay out and drill the holes through the stripper and die and into the clamping block *C C*. You can now use the clamping block *C C* for a jig to drill the holes in the mandrel die *L*.

A piece should now be milled to shape for the punches. Harden a piece of the punch steel and use it for a drift to finish the holes after working out almost to size. The die in mandrel *L* should have about 1½ degrees clearance. Stripper and die, *G* and *F*, should not have clearance. After finishing the holes, *F* and *G* are shaped cut to the curve indicated in sketch.

The dovetailed die piece in *L* will be best hardened in oil, as it is a "foxy" one to harden in water; and if made solid with the mandrel, it will be next to impossible to make it stand.

The punch for this die is shown in Fig. 19. The holes for the punches are drilled from the die *F*, Fig. 17. Punches should be backed with the dovetailed steel pieces *K K*.

It will be well to keep in mind that the dimensions you must keep accurate are inside; therefore make your punches and mandrels exactly to finished sizes. The dimensions given on the sketches are for stamping 1⅛ x 1¼ inches of stock—the quality we use, .065 inch thick, annealed after the second operation. Some stock will require to be annealed after each operation, and much of the stock, sold for

Fig. 6 A.

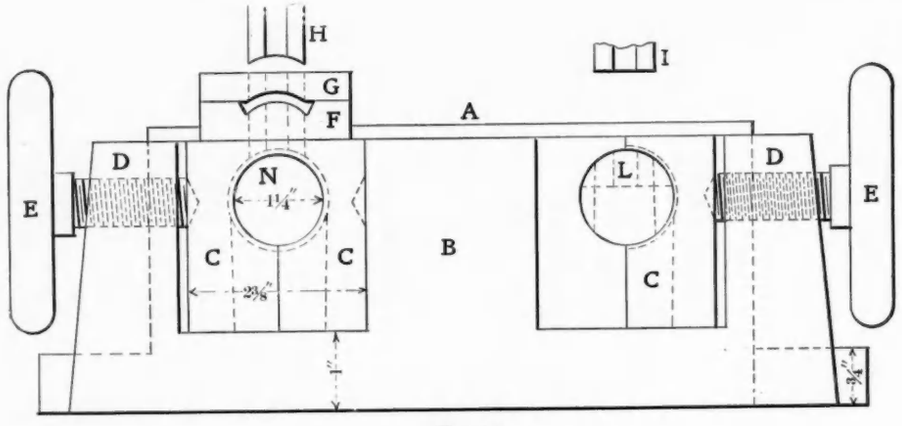


Fig. 16

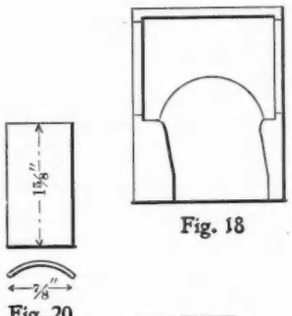


Fig. 20



Fig. 18

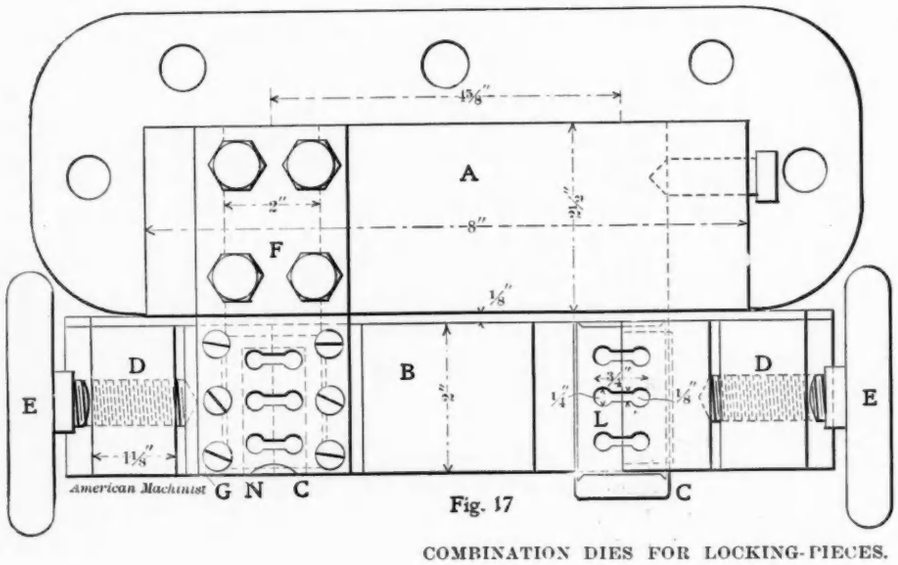


Fig. 17

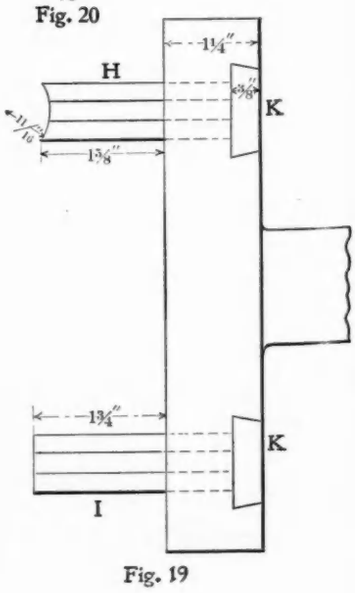


Fig. 19

COMBINATION DIES FOR LOCKING-PIECES.

"dead soft," will not stand the work, no matter how treated. The quality of stock will also be a factor in the amount of clearance between punch and die, Fig. 3.

For these points, and for the size of blanks there can be no arbitrary rule. You will be safe on the blank given for this stamping, with any stock, as there is sufficient allowance made for trimming off the strained edges.

Niagara Falls, N. Y.

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## Frog and Switch Planer.

We illustrate herewith, by an outline sketch, Fig. 1, some features of a frog and switch planer which have recently come to our notice. We refer to the method of bracing the housings and the method of mounting the bull wheel shaft, which are obviously the result of careful study of the strains to be provided for. The system of bracing speaks for itself as being final in its disposition of the metal for maximum stiffness.

Some whose opinions of what is correct in outline are merely a reflection of what is common practice, may be disposed to criticise this design from the standpoint of looks, and it is not impossible that some may even call it ugly; but those who have absorbed the fundamental truth that true beauty in machine design can only exist in consequence of the perfect adaptation of means to ends, being in fact the expression of such adaptation, will look upon this construction in its true light as a work of art. Despite its almost universal use, the parabolic outline is not correct for this purpose. That outline gives a beam of maximum strength for a given weight when, and when only, the beam is of uniform thickness. When flanges are put upon the housings, as they must be on the front faces and often are on the rear, and when holes are cut through as they always are, the parabolic form loses its significance entirely and is no longer appropriate for the strains to be met. The only correct outline for these conditions is the one seen here—a series of straight braces meeting the upright flanges at various points. The parabolic form with a back rib, is practically a crooked brace, and a crooked brace is as fundamentally wrong as is a crooked post, and for the same reason—a fact which is lost sight of in architectural work quite as often as in machine design.

It is interesting in this connection to note the staying powers of tradition on machines of long-established position. It is an undoubted fact that the outlines of machines which are comparatively newcomers in the shop, are better in this respect than those of the old-timers. Lathes were about the first standard tool, and were such long before any intelligent study of these questions was made, and there are more nightmares perpetrated in lathe legs than in any other feature of machine tools—and bad outlines in lathe details are by no means confined to their legs. The planer came in later than the lathe, and average planer design as a whole is, in this particular, far superior to average lathe design. The milling machine is still newer, and many milling machines, as well as many special modern tools, leave little to be desired. It would seem as though in designing a new tool on which tradition has set no stamp, the designer feels himself free to follow what education indicates as correct, and in designing a tool of an old type, the fear of appearing to be too radical, or of offending someone's prejudices leads to a constant repetition of what is known to be wrong, because it is "the practice."

The mounting of the bull wheel is also shown in Fig. 1. It will be seen that the housing is carried forward below, and in it is placed the bearing of the bull-wheel shaft—thus providing solid metal without joints between this bearing and the cross-rail. Another feature of value in such heavy work is the side bearings of the table on the bed, shown in Fig. 2, and designed, of course, to resist the tendency of the table to lift in the V's under the pressure of heavy side cuts. Additional rigidity is also secured by the very deep top brace and the great thickness of the housings, which measure 10 inches across the face on a 36-inch machine. On this size of machine the cross-rail is 18 inches deep, and the saddles are 24 inches long. The bull wheel is of 2 inches pitch by 9 inches face, of steel, and cut from the solid. The ratio of belt to table speed is 194 to 1. These dimensions indicate the rugged character of the work which the tool is capable of. In ordinary work on steel rails the machine is designed for two cuts, 2 inches wide with 1-16 inch feed, but is capable of much more. One of the exhibits of the manufacturers is a chip from a steel rail 2 inches wide by 3-16 inch thick. The planer is made by the G. A. Gray Company, of Cincinnati.

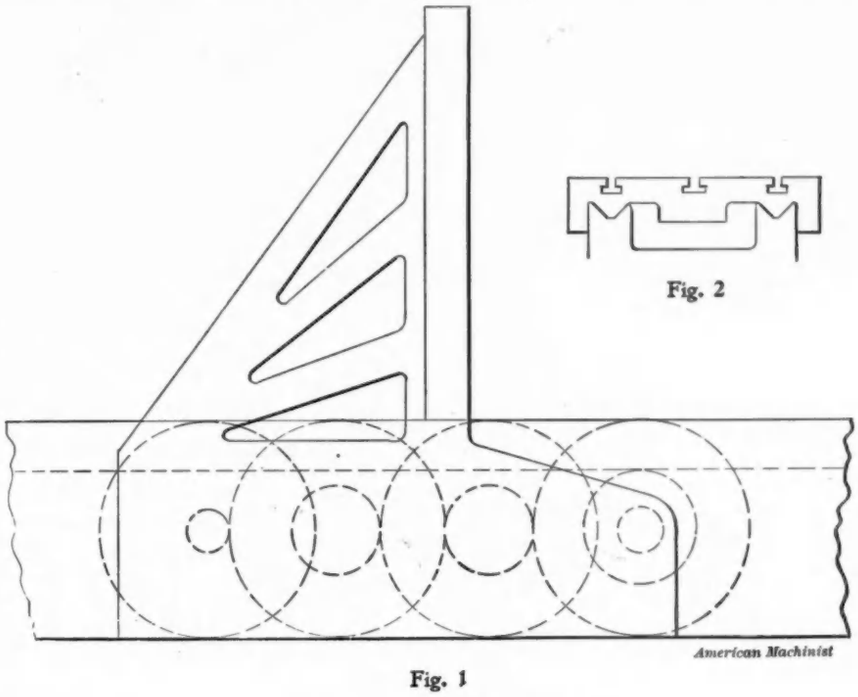


Fig. 2

Fig. 1

FROG AND SWITCH PLANER.

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## Boring Long Cylinders.

Editor American Machinist:

In regard to your answer to Question (18), "Is it practicable to bore a 6-inch cylinder, 12 feet long, with a boring head 2 15-16 diameter, with traveling head?" It is very doubtful if this method will give good results. The cutter head will probably follow the core hole, and make a crooked job. It is not customary to use a cannon drill for this purpose either, although undoubtedly it would be a way to do it. In boring printing-press molds, which demand round, straight and smooth holes, it is the practice to *pull* a double-end cutter through the holes, afterwards pulling a reamer through for finishing. Undoubtedly, this is the most rapid as well as the most accurate way to do the job. The boring bar being in tension, the cutter head remains central and does not follow the core hole. The mold or cylinder must be held in a vertical position. Bores of any diameter, from 2 inches up, and of any reasonable length, can be finished in this manner very cheaply and rapidly.

HENRY BINSSE.

Newark, N. J.

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On the day this paper appears we shall have a new Administration at Washington. We shall hope it will bring all the prosperity expected of it. Success to it!

## Bicycle Spoke-Threading Machine.

We present herewith an illustration of an improved bicycle spoke threader which is the outgrowth of experience with a preceding machine, and besides being designed with special reference to the production of better threads than are often made on spokes, will thread them very rapidly also, being partly automatic in its action.

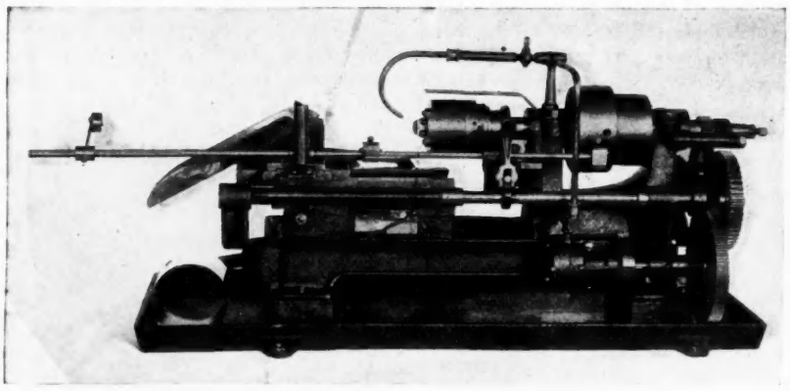

Fig. 1.

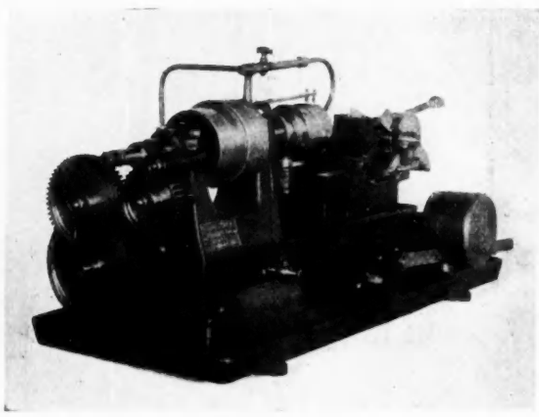

Fig. 2.

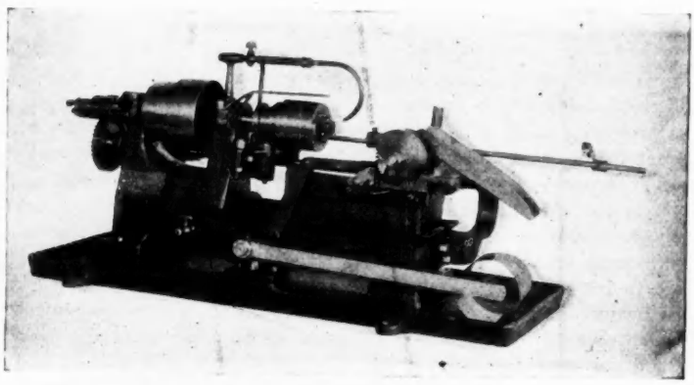

Fig. 3. SPOKE-THREADING MACHINE.

In operating this machine, the spoke is placed in the vise with one end against the adjustable stop shown at the left in Fig. 1. The vise jaws are moved by right and left hand screws, thus always bringing the work central. A movement of the hand lever, shown at the side of the machine in Figs. 2 and 3, clamps the spoke and engages the nut with the lead screw by means of a cam, which also automatically releases the nut at the proper time. These parts are shown in Fig. 1, the nut being above the lead screw. After thus raising the hand lever and engaging the lead screw, the spoke is threaded, the dies are opened, the spoke is withdrawn and dropped and the head closed by means of automatic attachments. The pump shown in Fig. 1 throws a strong stream of lubricant on the work at the cutting point, thus removing all chips, as well as keeping the work and dies cool. If desirable, the head may be opened at any time by pressing on the hand lever arranged for this purpose, and shown in front of the die head in Fig. 1.

Any desired pitch of thread can be cut by using a change gear of the same number of teeth as the number of threads per inch to be cut. The die head is surrounded by an oil shield, which prevents the oil from being thrown around. This was removed when the photographs were taken, and is shown in the oil pan in Figs. 1 and 3.

The lead screw has ratchet threads, is relatively large in diameter, and relieves the dies and work of all but the purely torsional stress.

Comparatively few threads are used in the dies, the lead screw being depended upon for the pitch; accuracy in this regard being thus secured. This, with the forced lubrication, high and uniform speed, solidly held dies that open and clear the thread as soon as completed, is found in practice to avoid many of the difficulties usually encountered in threading spokes. The machine is made by the Detrick & Harvey Machine Company, Baltimore, Md.

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## Humbug About Bicycles.

The daily newspapers have for some time employed men who write every day from a column to two columns of more or less interesting matter regarding bicycles and bicycle riders. These writers usually do very well so long as they confine themselves to the gossip and news pertaining to wheeling, but when they touch upon mechanical matters, they usually succeed only in contributing to "the gaiety of nations."

Here is one who writes for the "New York Times," for instance, describing an improved bearing seen at the recent cycle show, and who says that "only three balls are used, the inventor's claim being that he thereby does away with six-ninths of the rolling friction on each end of the hub, or twelve eighteenths in all, and so allows no motion to go to waste." It is also explained that the balls are seven-eighths of an inch in diameter, and that this is to gain a "proportional leverage over the three-eighth balls ordinarily used." If this man should conclude to abandon newspaper work, he could easily secure a good position as a professor of mathematics.

It is, however, small wonder that the public is misled on mechanical matters pertaining to bicycles, when we consider that many of the features of bicycle shows or exhibitions are simply humbug; nothing more or less. For instance, the man who holds a spindle in his fingers in a vertical position, and spins upon it the hub of a bicycle wheel, and shows you that his wheel bearing thus set in motion runs much longer than the bearing of another builder, is simply humbugging. He is using an ordinary lateral bearing of a

wheel as a thrust bearing—running it in a position in which it is not designed to run in service—and we all know that the best thrust bearing and the best side bearing are two entirely different things. We also know that the length of time a bearing will spin without any load upon it whatever is absolutely no indication of the value of the bearing for actual use, and any such exhibition literally gives not even a scintilla of evidence in favor of the bearing which spins longest as the best; yet the public and the wheeling correspondents of the daily papers are, of course, greatly impressed by such humbuggery.

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## Proposed Extension of the Use of Compressed Air on Men-of-War—III.

BY P. A. BARTLETT, P. A. ENGR., U. S. N.

The ventilation is arranged for, partly by the method of allowing the air to escape into the compartments from the heater pipes (thus supplying the pure air needed) and partly by allowing the impure air to escape. At one of the upper corners of each compartment, or at several points well up at the top in a large compartment, there are ducts leading to ventilators above the bridge deck. Many of these pipes combine as they lead towards the ventilator, the duct constantly becoming larger. These ventilators are plainly marked "Exhaust," and are always trimmed away from the wind, so that there is always a natural draft upwards from each compartment. Non-return valves, to prevent water from flowing from one compartment to another, in the emergency of a compartment being flooded, are fitted at the openings of each of these pipes.

### ECONOMY AND UTILITY.

Considering the air machine as a single machine, there is unquestionably a great loss in the use of air; but when we consider the use of air on board ship, it is questionable whether there is a loss of efficiency or not. In the first place, the fact of centralizing the power as far as possible is a source of economy; then it should be remembered that most of the machines run by air as described above, are used only at intervals and only for short periods, and sometimes not for days or weeks. Before using these machines, if steam be used as the motive power, the heat expended in heating the cylinders, valves and casings is largely lost, as this heat is left to be dissipated after the machine is stopped. The steam in the steam and exhaust pipes leading to the machine is cooling constantly all of the time, whether the machine is in use or not. If a valve adjoining the auxiliary exhaust line be closed as well as the valve at the machine, the steam inclosed in the pipe is cooled and the heat entirely wasted. The steam in the long auxiliary steam and exhaust pipes is constantly cooling, and heat is constantly being lost. There is no loss with the use of air, except the regular economic loss of reconverted energy, which, of course, is very large, to be sure, the leaks in the two cases being about the same. There are none of the losses above mentioned, the engines starting at once also, which is a very important consideration. When the one valve is closed at the machine, no loss occurs. If the valve at the top of the central plant room be closed as well, the air contained between these two valves remains ready for use, with no loss. Another important loss from using steam comes from the long lines of exhaust pipes, with their many joints at bulkheads; and at the ends of sections of pipes, the many slip joints and valves. These may all leak, and a loss of vacuum occurs that it is practically impossible to prevent. The larger losses may be found; but the little ones, that combined make up a big leak, cannot be remedied. When all the exhaust lines are in the one room, and all are short and go directly to the condensers in the same compartment, it is quite feasible to have a good vacuum, and thus add to the economy of the centralized plant, as against the poor vacuum for the exhaust from all the detached machines, in the case of the use of steam everywhere.

Other important economies come in the first cost. Only one small uncovered pipe leads to each machine. The pipes for the air pressure are not as expensive as the copper ones, worked by hand, for the use of steam. Double the number of these pipes and valves have to be led to machines all over the ship, with the added expense of drain pipes, slip joints, bulkhead stop valves, and traps in quantities, any one of which latter might pay for the line of air pipe required. Expensive pipe coverings must be fitted to these steam and exhaust pipes, drains, traps, etc. The air pipes are simply painted.

With the three sizes of engines and pipes, only three sizes of spare parts need be carried for all the auxiliary machines, and few of each. Pipe jointing material is largely saved.

A distinct saving in many ways is found in the use of oil. Any kind of lubricating oil may now be used in the air cylinders, as none of the oil gets back into the boilers. Any cheap variety of lubricating oil will do, instead of the special, vacuum-treated, expensive oils generally used in steam cylinders. Another feature is the longer life of the machines, from the use of air in the cylinders instead of steam. The oil is not burned out by the hot steam, and the residue does not settle on the surfaces of the cylinders and in the clearance spaces as a hard deposit, difficult to remove and rendering the action of the pistons irregular. Less oil will do the work, and the oil remains as oil until used up.

In case of a pipe shot away in action, the advantage of the use of air is overpowering, as in one case life-giving air is supplied, and the other brings death.

### COMPARISON WITH THE USE OF ELECTRICITY.

In the cases of electricity and air, it is first remembered that both are reconverted energies, and neither can be as economical as steam, theoretically. With the present appliances, there seems to be no doubt that electrical energy is obtained with more economy than air energy. Theoretically, electricity is the perfect source of power for the auxiliaries on board ship; but practically, it fails regularly, in spite of the strenuous attempts to have it used for all purposes. Possibly it might do better if it were under the control of engineers on our men-of-war; but even then there are many reasons why electricity is not the proper force to use for this purpose. Electric power is led from the dynamos in main lines to all parts of the ship where needed for auxiliaries. Branches from these main lines go to the different machines. In case of the grounding of one of these branches, that main line must be shut off, and no machine connecting with that line can be used. The leak is a very hard thing to find under the best of conditions, with all the quiet of ordinary routine, and often it takes hours and sometimes weeks to locate it. Sometimes it is not found at all, and the dynamos run months with grounds that cannot be discovered. After the locating of the leak, the repair must be made. This is generally a short piece of work. In battle it would be practically impossible, in the noise and confusion, to locate a leak at all. Thus all the machines on that line become inoperative. The smallest and most unimportant machine in the ship may cause the stopping of many important ones. Also, when we find that almost daily electric appliances are out of order, it is sure that this source of energy is not yet in such a state of advancement as to justify its use for anything that must be sure to go, except under the most extraordinary circumstances.

If one of the main lines of electric conduit becomes suddenly shot away or grounded, the chances are many to one that the dynamo will be ruined before that line is switched off or the machine stopped. Then all the machines are ended on that line, and all electrically driven machines in the ship are stopped if the dynamo is shut down while another one is being started. The leak is still to be found and remedied.

The currents could not be sent by separate lines from the dynamo to each machine, as the loss of energy would be altogether too great, from the increased resistance.

Another great source of danger from the use of motors about the magazines and ammunition hoists, or where powder is handled, is from the possibility of sparks setting a few grains of powder afire. It

is said that modern powder does not ignite in this manner, and it is true enough for the powder for the larger guns; but powder that will ignite is on board, and is liable to be where it may cause just the catastrophe that all say is so improbable. It is better to keep sparks away from where powder is being handled, especially when the methods of handling powder are so crude as at present and the men so careless. Also, there is the possibility of fire from electricity—small possibility, to be sure, on a modern-built ship; but still, the chance is there.

An air pipe could be shot away with loss only to the machine to which the pipe leads, the escape of air being generally a godsend in the hot places below. The air compressor in the central plant room would have to make a few strokes a minute faster, regulated by the governor, till word is sent to the room to close off the valve to the defective pipe. If word be not sent, the device in the central plant room attached to each pipe shows at once if the pressure falls abnormally in any pipe, and the attendant closes the valve.

The small pipes for air are not more expensive than the electric wires, junction boxes, wooden coverings and insulations at bulkheads.

SUMMARY.

Air is better than steam for auxiliary use on board ship, for the following reasons: The ship is cooler in summer, and men are not debilitated by the heat; there are no hot bulkheads all over the ship; the auxiliary machinery and pipes last much longer; half the number of valves, pipes, etc., are needed; there are no ventilating blowers, the heater lines doing the work; there is great saving in cost of plants and in the cost of oil; no pipe coverings are needed; the machines are ready for use at once; there are fewer men on watch in port, and more for general work; the launch is ready at any moment, at sea or in port; there is no smoke, heat, etc., and only one man is required.

It is needless to say that all the machinery is in charge of the chief engineer of the ship.

If it be found that the theoretical scheme in this hurriedly written article be not entirely possible in practice, a portion of the idea may be carried out. Possibly, by using steam for the largest machines, the general idea could be carried out for the rest of the machinery. It is certain that something must be done to relieve the officers and crew of our men-of-war, of the suffering from the terrible heat on these ships in summer.

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## A Wrought Steel Pulley.

We illustrate herewith a pulley which is of interest both as a pulley and also as an article of manufacture. It is made up of sheet steel pressed into shape cold, without castings or forgings (unless the bolts and rivets be called forgings), and without machine-tool work, in the ordinary sense of turning, planing, or drilling. Even the joint between the halves is made with the shears, supplemented by heavy pressure when the halves are formed in shape—the result being a joint which, on inspection, would be assumed to be planed.

A feature of the manufacture is the slight amount of waste involved in the processes followed, as indicated by the fact that the weight of the finished pulley is greater than that of the sheet metal from which it is made—the bolts and rivets adding more weight than the punches and shears remove.

The general appearance of the pulley is shown in Fig. 1, but its construction will be better understood from Fig. 2. The rim will be seen to be divided circumferentially through the center, a flange being turned inward for riveting the halves together and also to furnish an attachment for the arms. The outer edge of the rim will also be seen to be rolled, in order to provide for the use of pins to insure the pulley halves forming a fair flush joint. This roll also provides a round edge to the pulley, which is, of course, desirable.

Examination of Fig. 2 will show how the pulley is put together. The hub is formed of half sleeves to which are riveted the hub sections of the arms, while outside of these are the clamps for pinching the pulley on the shaft. Our understanding of the formation of the spider, including three spoke halves and a hub section, is shown in Figs. 3, 4 and 5, from which the economy of material secured in the manufacture of the pulley will be plain. A piece of sheet metal of the form shown in Fig. 3 is first slit as there shown. After slitting, the end is bent up as shown in Fig. 4, when, the hub portion being further bent as shown in Fig. 5, the slit portions take the form of radial arms. The hub section is riveted to a half bush, as will be seen more clearly in Fig. 2.

The split bushing system for adapting the same pulley to different sizes of shaft will be employed, as with wood pulleys, but in this case the split bushes will be of steel. We have always believed the interchangeability growing out of this system of bushings to be the chief factor in the popularity of the wood pulley, and it will, no doubt, have the same effect with this. This pulley is, of course, much lighter than those of cast iron, and is even said to be lighter than those of

Fig. 1.

Fig. 2.

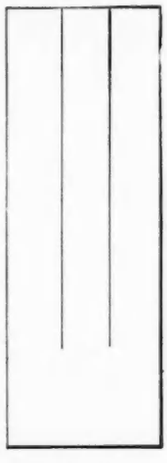

Fig. 3

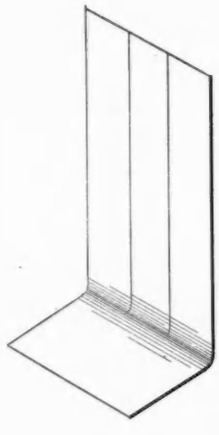

Fig. 4

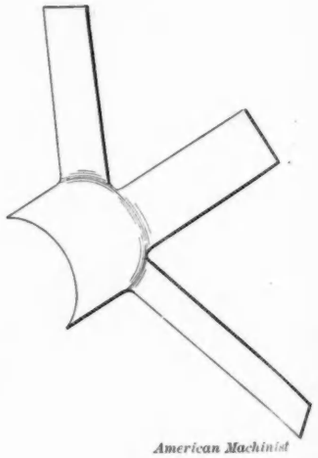


Fig. 5

WROUGHT STEEL PULLEY.

wood, while of its strength there is, of course, no doubt. To this the corrugations in the arms contribute greatly.

The pulley is the outgrowth of large experience in the working of sheet metal cold by its inventor, Mr. Thos. Corscaden, and it is being placed upon the market by the American Pulley Company, of 18th and Hamilton streets, Philadelphia, Pa.

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## A Serrating Machine.

We present herewith front and rear views of a machine designed especially for work of a somewhat peculiar nature, and called a serrating machine. It is used mainly for serrating the edges of sickles used in reaping machines, but is also adapted to similar work on other pieces, such as header-plates, band-knives, straw-knives, etc.

In its method of operation and the work it produces, the machine somewhat resembles a file-cutting machine, and its object is to produce a surface somewhat similar to that of a float file, the serrations being formed by a rapidly striking chisel, placed at the extremity of a vibrating arm, which strikes from 800 to 1,000 strokes per minute.

The front view of the machine is shown as adapted for reaper knives, and these are clamped by a lever upon the top of moving slides, which slides are moved by the worm gearing and friction clutches shown at the rear of the machine. These friction clutches are thrown into engagement by the levers seen at the extreme right and left, and are automatically released at the proper point, gravity then returning the slides to their initial positions.

The vibrating arms are moved by the cams upon the overhead shaft. Powerful springs which are inclosed in the spring cases (seen most plainly in the rear view under the arches) give the motion in the opposite direction, and impart to the blow the quality of spring or quick recovery, which is necessary where such operations are performed with such great rapidity.

As will be seen by the engravings, all necessary stops and adjustments for various kinds of work are provided, and the machine forms an interesting example of a large class of special machinery used in manufacturing operations. It is made by the Webster & Perks Tool Company, Springfield, O.

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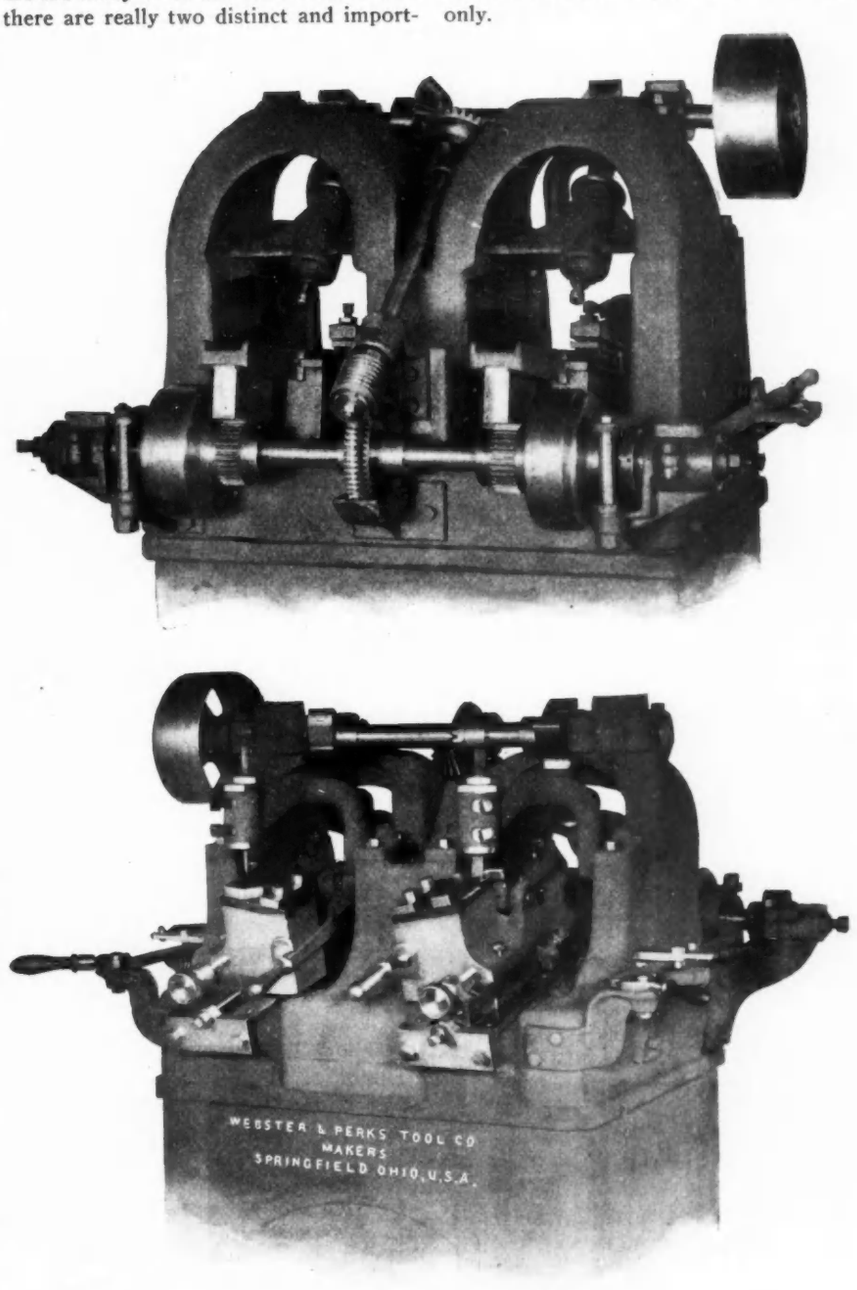
"Engineering," London, quotes from the "Shipping World" that our belted cruiser "New York" cost, with extras, twenty-three cents per pound. If we mistake not, we have known Corliss engines built for three cents a pound. Luxuries, of course, come high; Corliss engines are merely useful. But it is certain that where any good reason for constructing naval vessels exists, there is reason for making them as good as possible, regardless of their cost.

## Some Examples of Grinder Work—An Improved Twist Drill—An Engine Crosshead—The Corliss Wrist-plate Motion Discarded and Discredited—An Approach to Perfection in Machine Construction—A Shop with Decent Sanitary Appliances.

It seems to me, Mr. Editor, that there are too many of us who fail to realize that there are really two distinct and important functions of the universal grinder in machine construction. Most of us are familiar with one branch of its legitimate work, but I am continually encountering good mechanics who seem to be entirely ignorant of its other and perhaps equally important field of usefulness.

When these machines first began to be seen in our machine shops, they were found in tool-rooms only, and no one ever thought of putting a piece of work into them unless the work was of hardened steel, which needed to be true and round, and could not be made so in a lathe. The grinder was looked upon solely as a means of producing refined or superfine work, costing a good deal of money, and a great many good men who ought to know better still regard it in this light only.




A SERRATING MACHINE.

I can perhaps best show the fallacy of this view by describing some jobs which I saw being done in the shops of the Davis & Egan Company, at Cincinnati. There were a number of these jobs, and I give sketches of two typical ones at Fig. 1. Both these pieces form minor parts of feed mechanisms, and do not require to be at all fine pieces of workmanship. The

lathe would finish them good enough for all practical purposes, and does finish similar parts in most shops, with entire satisfaction, so far as quality of work is concerned. They are made of machinery steel, and are formed from the bar in a turret-head screw machine, the box tools

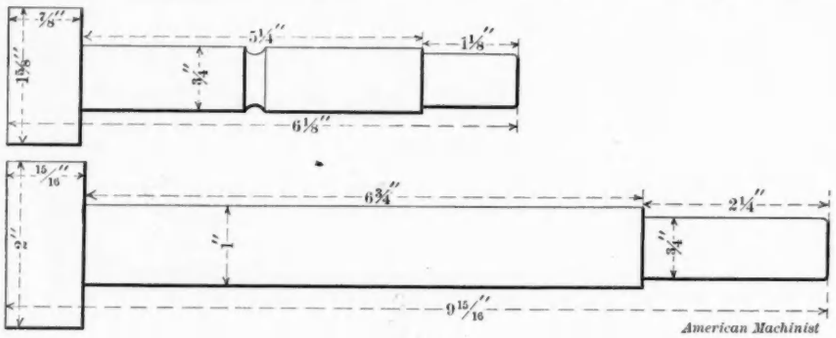



Fig. 1

LATHE WORK DONE WITHOUT A LATHE.

bringing the sizes within about .003 inch of the finish. The outward end of each piece is centered by a tool provided for that purpose in the turret, and afterwards, the other end having been also centered, they are put upon dead centers in the grinder and finished to gage. No lathe work whatever is done upon them, and the point I wish particularly to call attention to is, that the lathe is not discarded because it will not do such work good enough, but because the screw machine and the grinder will produce the work at lower cost. Its incidental superiority of finish and accuracy is, of course, not objectionable, but is, at least, not the controlling consideration in this case. The enlarged ends of these pieces are pinions, the teeth of which are cut while the pieces are held by the centers, and thus the tooth-cutting is true with the bearings, though the tops of the teeth, which are not ground, may not be precisely true, and do not require to be.

These jobs, and lots of others like them, might in this and other shops, form profitable subjects of study by very many who still retain the idea of the universal grinder, which prevailed in the early seventies and for some time after, but has now been displaced among the best informed, who know that a good deal of plain unhardened work may be finished and brought to size on the grinder more cheaply than in any other way, entirely regardless of the fact that its work is usually superior to that of the lathe.

AN IMPROVED TWIST DRILL.

We have heard a good deal lately about twist drills with lubricant tubes in them. They are wonderfully efficient and interesting, and Mr. Chard, the superintendent of the D. & E. shops, showed me a drill devised by himself, quite a while ago, and which seems to me to have some advantages peculiar to itself. At Fig. 2 I show a section of it. Instead of soldering brass tubes in the grooves, a dovetail is formed at the top of them, and a strip of brass, suitably formed, is slipped into this d vetail, as shown, and soldered. It is more expensive than the common method, but it has the advantage that much less of the drill needs to be cut away for a given oil-carrying capacity, and the strip is very securely held; making a neat and good-looking job.

AN OLD SHOP REJUVENATED.

One of Cincinnati's interesting shops (which, however, is not in "Cin'ti" at all,

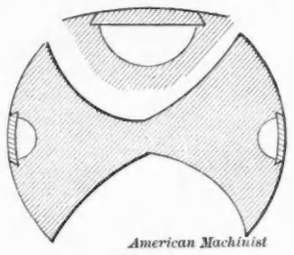



Fig. 2

SECTION OF DRILL.

but across the river in Covington) was built long "befo de wah," and locomotives were at first constructed within its substantial stone walls. It would scarcely do for a locomotive shop now, but it answers the purpose of a stationary engine shop very well, and is occupied for that purpose by Houston, Stanwood & Gamble. Though forty years old, or over, this shop has some of the features generally considered quite modern. It is 80 feet square, two stories, but the upper story is a gallery only, and extends around all four sides of the building, instead of two or three sides, as is now the fashion. At or near each of the four angles formed by the interior line of this gallery, is a round iron column, and on each of these columns is a jib crane, the four cranes covering pretty nearly, if not quite, the whole lower floor space. Mr. Stanwood, who manages this shop, wanted to raise the lower pintle or point of support for these cranes, in order to gain head-room; and to get a good bearing on the column where none had been originally provided, he made a two-part mold of the end of the strut which was to embrace the column, put it in place, and poured in melted zinc, thus forming on the column a solid ring of zinc, which gives an excellent bearing, obtained with little expense or trouble.

AN ENGINE CROSSHEAD.

The engine made here has been the subject of illustration in the "American Machinist," and will be remembered by many as an example of originality in design. No other engine that I know of is just like it, and as the subjects of piston-rod fastenings, and of the proper arrangement of crosshead pin, have been under discussion lately, it may be worth while to glance at the sketch, Fig. 3, which shows the crosshead used on this engine. The piston rod is not "fitted" to this crosshead at all, in the ordinary sense of the term. It just passes through a hole in which it "fits like a rat's tail in a barrel"; or, in other words, is made so loose that, when things get out of alignment, it is only necessary to slack one of the nuts on the piston rod, restore the rod to its proper position, and tighten up the nut again. The pin is an absolutely plain cylindrical piece, of one size from end to end, and is held in place by clamping it tight by means of the studs and nuts shown, the cheeks of the cross-

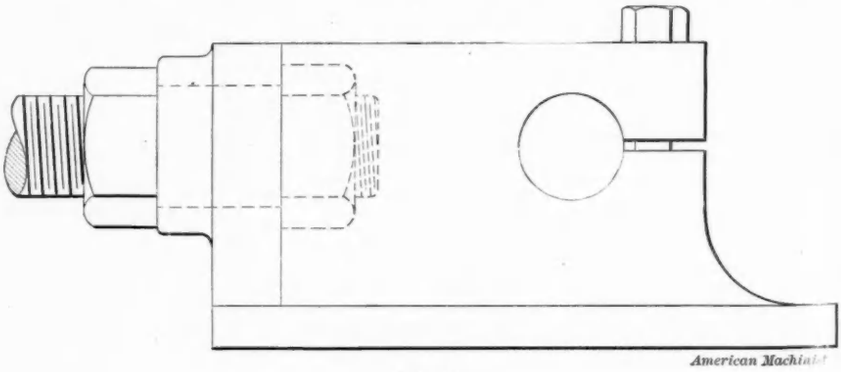



Fig. 3

A SIMPLE CROSSHEAD.

head being split for that purpose. This crosshead is certainly a very simple one to make, and it seems to me that its simplicity is not its only recommendation.

THE CORLISS WRIST-PLATE DECLARED A HUMBUG.

At Lane & Bodley's I found them testing an engine which I suppose will be

classed as a Corliss. It has Corliss valves, but no wrist plate whatever, and if you speak to Mr. Lane about this, he may give you a shock by declaring that much of the worship of the wrist-plate motion is mere superstition, and that there is nothing good in it which cannot as well be obtained otherwise. On this new engine he is using two eccentrics, and making the connection as direct as possible from one of these to the steam valves, and from the other to the exhaust valves. It makes a handsome engine, and there are other points about it which we may know more about some other time.

SOME LARGE ROLLED BARS OF STEEL.

Something I saw in this shop leads me to wonder if anyone knows just what the limit of size is for rectangular bars of rolled steel. Two bars I noticed on the floor were 10¾ x 3¾ inches, 30 feet long, and were beautiful specimens of rolling—smooth, straight and accurate to specified dimensions. A large hydraulic press is to be built in and for use by the L. & B. shops, and these bars are to constitute the side or tension members of the frame. The Carnegie establishment was asked to state how close they could come to specified sizes on such bars, and they refused to fix any limit of variation whatever—even an inch. All they could be induced to say was, that they would do the best they could, and their best turned out to be as good as could be asked, and better than would be expected by most of those who know something of the difficulty of accurately sizing such large pieces in the rolling mill. They vary from size not much, if at all, more than many ordinary small bars. The press of which they are to form a part, is to exert a pressure of 500 tons; there is to be 11 feet space between the bars, and the cylinder will be 16 inches diameter, 4 feet stroke.

THE NEAREST APPROACH TO PERFECTION IN MACHINE CONSTRUCTION.

In a room by itself in the basement, under the office portion of the shops of Warner & Swasey, at Cleveland, is a machine, the general form of which is cylindrical, about 4 feet diameter, somewhat less in hight. A machinist, looking it over casually, might say: "That is a fine-looking machine, and must have cost as much as $2,000 to build." It has actually cost about $10,000 so far, and will cost more by the time it has received the last finishing touch; the difference between what would be the cost of an ordinary well-constructed machine of similar design, and this one, being explained by the fact that this is one of those rare machines in which any cost whatever is considered to be justified so long as a nearer approach to absolute perfection can be attained thereby.

The machine is an automatic dividing or graduating engine, designed to place upon finely finished surfaces of silver—to the naked eye—invisible lines upon the circles and verniers of astronomical instruments, by which such extremely delicate angular measurements as those connected with the investigation of stellar parallax are made.

Surmounting the cylindrical frame or base of this machine, is a plate, 42 inches diameter, which revolves in a horizontal plane by means of a worm which engages with worm teeth cut in the outer edge of the plate. In the upper face of the plate are three rings of silver, which are graduated with lines so fine as to be scarcely, if at all, visible, except with a microscope; several of which latter are placed at different points about the circle for this purpose. The circle itself is attached to a taper spindle or shank, which extends nearly, or quite, to the bottom of the machine, and has been fitted to its bearing as perfectly as the highest skill will attain; a very refined process of grinding together being the last operation. Most of the weight of the moving parts is borne upon a ball thrust bearing at the bottom, which is supported upon three points, so that it can adjust itself freely and exert no disturbing influence upon the main bearing.

An idea of the refinement of fit of this large spindle in its bearing, may be gained from the fact that it is found, by trial, that when the plate so supported as to turn freely, it will turn hard if the spindle is lowered in its bearing so much as one-thousandth of an inch.

It is a well-recognized fact that no graduating engine can be made absolutely perfect when its work comes to be tested by the marvelously refined methods at command of the skilled astronomer, who deals with single seconds of arc as we deal with thousandths of an inch; and when we consider what a second of arc means, and that on this circle of 42 inches diameter an error of one second of arc would mean the displacement of a line, only a very little over one-tenth part of a thousandth of an inch, we begin to have some appreciation of the kind of target which is aimed at in the construction of such a machine. It is certain that the error in the machine is less than this amount, but just how much less is not yet determined. The machine is, as Mr. Swasey expressed it, "only roughed out" as yet, and the work of refining and perfecting it is yet to be completed.

Very admirable dividing machines have previously been constructed, both in this country and in Europe. It has been hoped, and Messrs. Warner & Swasey will now go so far as to express the rather strong hope that this machine will prove to be nearer absolute perfection than has been heretofore attained. We can all join in this hope and in the satisfaction to be derived from the prospective advance toward perfection attained by machine constructors, and my further hope is that, when the proper time comes, the "American Machinist" will be able to give its readers a full, detailed and illustrated account of this machine.

DECENT SANITARY APPLIANCES IN A SHOP.

To go from the discussion of this graduating engine to the subject of shop water-closets may perhaps be suggestive of the transition from the sublime to the ridiculous, but the sanitary arrangements of shops are receiving more attention than was formerly the case, and it is being recognized more and more that an abomination is just as abominable in a shop as anywhere else.

In another portion of the same basement is a row of water-closets as good in every respect as can be found in most first-class hotels. The woodwork is of finished cherry, all the modern and most approved sanitary plumbing and fixtures are there, and as in the case in hotels, there is a man, part of whose duty it is to see that this place is kept in order and in no way abused. The usual spring-closed doors provided in such places are here, so that the same degree of privacy is secured that is considered appropriate for other people; in short, all the disgusting and degrading features of such places, as usually found in machine shops, are conspicuous by their absence, and there seems to be a full and complete recognition of the fact that machinists can appreciate decency, and can be as decent as any other class of men if afforded the same chance. I wish the shop proprietors who maintain some of the disgusting, self-respect-destroying, abominable nuisances I see in my travels, could look upon this place in Warner & Swasey's shop, and think what it means in the way of decency and humanity, and in attraction for self-respecting, intelligent and ambitious men.

USEFUL COMBINATION OF A RATCHET DRILL AND A STRING.

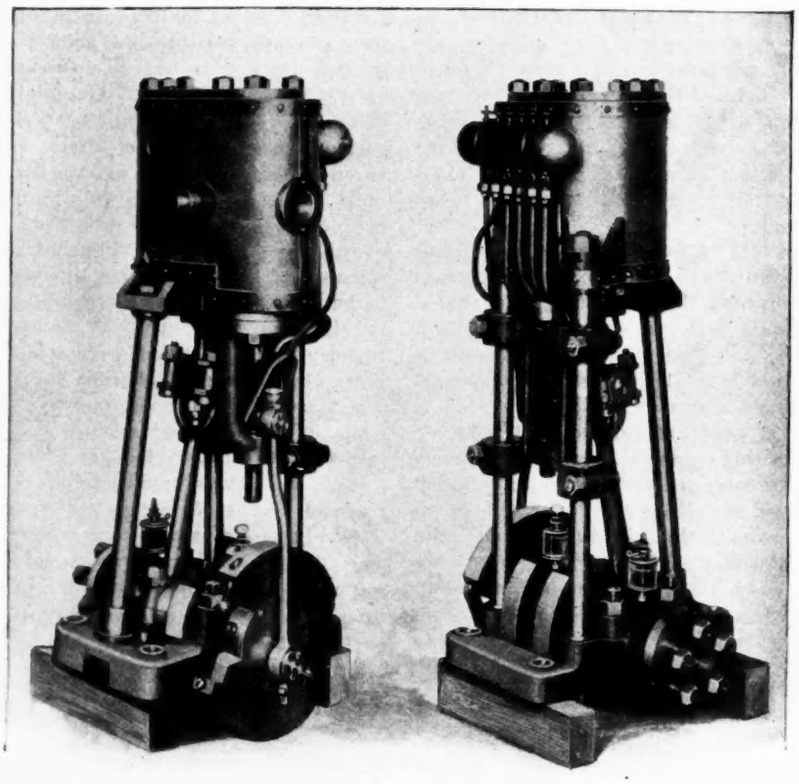
In going about the shop with Mr. Swasey, we noticed something suggestive of the story about the boy who tied strings to the engine to do the work of valve-opening and closing which he had been hired to do. There was a Gray planer which had been provided with a post at one side of the bed in front of the housings, and this post was fitted with a vertically moving saddle for the purpose of planing side cuts on pieces too high to go under the cross-rail. As there is not a great amount of such work to do, it had not been thought worth while to provide this saddle with automatic feed, but it was intended to be fed by hand, a hand-wheel being placed at a convenient hight at the side of the post, and connected to the vertical feed screw in the post by a shaft and spur gears at the top.

Impelled thereto, probably, by considerations similar to those which actuated the boy, the man who was running this planer had replaced one of the spur gears at the top of the post by a Renshaw ratchet drill, the handle of which projected horizontally out over the planer

platen. Attached to the handle were two long pieces of twine, one carried forward and attached to a stake in the planer platen, and the other carried back and similarly attached. Thus the planer platen, in moving back and forth, swung the handle of the ratchet drill first one way and then the other, and did the feeding automatically; the amount of slack in the twine determining the amount of swing of the handle, and thus the rate of feed; and as the pawl in the ratchet drill is reversible, the feed could be up or down, as might be desired.

It was plainly to be seen that Mr. Swasey appreciated the ingenuity of the trick, which was evidently as new to him as to me.

S. T. FREELAND.



A COMPACT LITTLE ENGINE.

## A Compact Little Engine.

We are enabled in the accompanying half-tones to lay before our readers an interesting little engine recently added to the list of W. D. Forbes & Co., engineers, Hoboken, N. J. It may be well at the outset to get a realizing sense of the dimensions of this engine, and then of the power it will develop. It is, as engines go, a little engine, the cylinder being 5 x 5 inches, running at 500 revolutions per minute, and with 100 pounds boiler pressure developing 10 horse-power, with good economy for a single-valve engine. The engine is similar in general design to the well-known line of vertical engines produced by this company. The cylinder is mounted on three steel columns, the two at the back being vertical, while that in front inclines inward from the base. The construction favors accurate and legitimate machine work throughout, and a remarkable accessibility of parts is secured. The valve is of the piston type, controlled by a compact automatic shaft governor. When for any reason desirable, a throttling governor may, of course, be used. The arrangements for oiling the various running parts are, as will be seen, a prominent feature of this engine. One oil tank is provided near the top of the cylinder, and independently controlled sight feeds distribute the oil to the several points requiring more or less constant lubrication. The running balance of the engine has been made a subject of careful study, with the result that, notwithstanding its high speed, it runs very smoothly and without vibration. The makers seem to have realized throughout the necessity of care in every particular as essential in the production of a successful and satisfactorily running and enduring modern engine. The total weight of the engine as shown is 306 pounds.

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## Mr. Barnacle on the Navy.

"Frequent in perusing the papers I see how no able seamen won't ship in these new cruisers, though the Navy wants 'em bad," Bill Barnacle remarked, looking over a tabulated list of disasters to Uncle Sam's White Squadron.

"I've noticed the same complaint regarding the scarcity of men," said the lubber. "Seems to me a sailor would take pleasure in wearing a beautiful uniform and cruising in one of those big white ships. Why don't they enlist?"

"It is singular how curious w'y they don't, as mariners is supposed to be proper fools," Bill replied thoughtfully. "They must be pre-judiced, I take it, against these here battle-ships wot sinks, sometimes, afore the mooring chains is cast off at the dock. Blow me, if I'd sign in no floating machine shop wot's liable to swamp or turn turtle if they ever gets her into deep water. Look wot's happened already to the fleet, and some of the blooming hookers ain't never been away from the dock, either. And likewise look at wot befell them as did."

Mr. Barnacle paused in absolute disgust to ruminate on the disgraceful conduct of our war-ships.

"This here navy ain't wot it used to be," he went on, somewhat sadly. "No proper out-and-out A. B. can sling his dreaming sack in one of these here findy sickle cruisers and be happy. Boilermakers, machinists and Swede painters is wot they wants these days. Wot's the use of sailors when there ain't no ropes, no rigging and no hauling and climbing? Nothing but electric buttons and hydraulics and similar gear, wot gets out of order and busts regular. Boat davits is the only ropes; no decks to holystone and not a smudge of tar from stem to stern. W'y, blow me down, if the camphor in the dress suits of squab midshipmen isn't the only thing an able seaman can smell aboard them ships."

"Have you ever sailed in one of the modern battle-ships?" asked the lubber.

"No," said Bill, "and likewise I won't; but I've knowed mariners wot has. They tells me that with continual painting and wiping it off accidental with their clothes, and losing thumbs in patent gun gear and acting proper polite, they might as well be janitors in Harlem. Wot's the use of signing as A. B. in a ship where you walks to the mast, presses a button and rides up to the main top or masthead in a blooming elevator? Next we'll hear of barber shops and restaurants and life insurance offices in the fighting tops, and likewise art studios and weather bureaus. When hollow masts with elevators takes the place of rope ladders and legs it's time for the mariner to tie up ashore.

"Besides, wot's the sense of going to the bottom in an iron coffin, or sinking alongside of docks and being laughed at by all the lubbers in creation? Sailors don't throw much swell on land, but they rates some pride at sea if the ship behaves herself and gives 'em a chance. But wot a holy show the navy does make of mariners, to be sure! Ship's always in a muggy mess somewhere, and being logged in the newspapers. Look at 'em on the other side! There's the coast defender 'Monterey,' built in San Francisco to blow war-ships out of the water twenty miles away. The day she was ready for sea they headed up the bay to Mare Island for more repairs and runs into a blooming

herring net. For three days this here terror of the seas hangs in the net with her propellers fouled in the snarl of meshes, while the Dago fishermen cussed frightful. Farmers and duck-shooters comes off in boats and gives the able seamen the horse-laugh, while divers is below clearing away dead herring and busted net."

"That was terrible," the lubber murmured, sympathetically.

"Likewise the survey boat 'Ranger' makes a ass of herself," Bill continued, with disgust oozing from every pore. "Sixty machinists works six months repairing the 'Ranger' for a trip to Alaska. She gets under way and is seventeen days making Port Townsend, Wash. All this time her vitals is thumping fearful day and night. Nobody can sleep, and the engineers roasts their blooming ears listening at hot steam chests and iron bulkheads to locate this here pounding. Just as she crawls into port the 'Ranger' breaks down. They overhauls the engines and finds a eight-pound monkey wrench in the main cylinder, left there by the brainy bosses at Mare Island. So the Government charters a tug at $600 per day to tow the 'Ranger' back to them turtles for more repairs.

"These here samples," concluded Bill, with a rippling string of oaths, "is w'y I claim the navy is a proper de-lusion and likewise fake."—Charles Dryden, in New York "Journal."

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## Repairs of Electrical Machinery—IV.

BY A. R. HARRIS.

### Multipolar Armatures.

In former articles upon this subject it has been shown how the wire is wound upon ring armatures of the two-pole type, and also how the terminals of the coils are connected with the commutator segments. To complete the subject, so far as it relates to two-pole machines, it would be necessary to explain the winding and connections of drum armatures; but as we can lead more naturally from two-pole ring armatures to multipolar ring armatures, we will in this article consider the latter type.

The only difference between a two-pole and a multipolar machine is in the number of poles that surround the armature; but this difference leads to a change in the path of the currents through the armature coils, this change consisting in reducing the amount of the armature ring traversed by the current in passing from one brush to the other, from one-half of the circumference to one-quarter or one-eighth, or some other portion dependent upon the number of poles. If the machine has four poles, there will be four separate currents traversing the armature wire; and if it has six poles, there will be six currents; and for eight poles, eight currents; and so on for any number of poles. This arrangement of currents with respect to the poles can be well illustrated by means of Fig. 1, which shows, diagrammatically, a four-pole armature with the ends of the poles in their proper positions. It will be noticed that counting around the circle, if the first pole we start from is positive, the next one will be negative, and the next to that will be positive, and this will be followed by another negative one; that is, the polarity changes from pole to pole, and any pole will be flanked by poles of the opposite polarity. This order is true whatever the number of poles may be. Remembering the action of the two-pole machine, it will be at once understood that the currents flowing in the armature wires on the outside of the ring will all run in the same direction if under a pole of the same polarity; that is, in the figure, the currents in the quadrant between arrows 1 and 2 will be in the same direction as the currents in the quadrant between arrows 3 and 4, and the same will be true of the currents in the two remaining quadrants. From this it follows that if, in the two opposite quadrants, the currents flow toward the commutator end, in the other two they will flow from the commutator. At the points where these four currents meet, they will be running in contrary directions. These meeting-points are where the arrows are placed. Now, if all the coils are wound just the same as on a simple two-pole armature, and are connected with the commutator in the same way, it is evident that the segments upon which the brushes *a b c* and *d* rest will be connected with the armature coils in which the opposing currents meet; hence, if leading-off wires are attached to these brushes, they will convey the current to and from the armature, the currents entering through brushes *a* and *c* and passing out through *b* and *d*.

In the figure it will be noticed that each current traverses one-quarter of the circumference of the armature; if the machine had six poles, the arc traversed by each current would be one-sixth of the circle, and for any number of poles the arc occupied by each current would equal the circumference divided by the number of poles.

The method of connection shown in the figure is the simplest of all, and is known as parallel connection. It can only be used with a number of brushes equal to the number of poles. The connections with the commutator are just the same as in the case of a two-pole machine, and when the coils are wound one on top of the other, the same precautions must be followed to avoid making false connections. In the majority of machines in actual use, this style of connection is used; but in some cases it is changed so as to get rid of the complication arising from the increased number of brushes, or so as to increase the voltage of the current. As will be seen, the pressure developed by the armature in the figure is proportional to the effect of only one pole, but the amount of current is equal to the product of two poles. If, however, the currents of the two opposite quadrants were connected in series, the amount of current would be that developed by one quadrant only, and the voltage would be equal to that of two. It might be inferred from this that we could take the current coming out through brush *b* and return it through brush *c*, and thus double the pressure; but this would not lead to the desired result. The only way to add the pressure of one quadrant to that of another is by cross-connecting the armature in such a manner that the armature coils of the opposite sections are interlocked, so to speak, with each other; that is, so that the current can pass through a coil of one section, and then a coil of the other section, and then return to the first section, and so on until all the coils are connected. With a four-pole armature, the armature is cross-connected by joining the coils that are diametrically opposite; with a six-pole armature, the coils connected are one-third of the circumference apart; and for any number of poles, the distance between the connected coils is equal to the circumference divided by one-half the number of poles. To cross-connect the armature in the figure, we would commence with the first left-hand coil in the upper quadrant of the armature, and connect the end coming from the outside of the ring with the first commutator segment on the left-hand side of the upper quarter of the commutator. From this same segment a wire would be run to the inside end of the first coil on the right side of the lower armature quadrant, and the outside end of this coil would be connected with the first segment on the right of the lower quarter of the commutator. From here a wire would run to the inside end of the second coil in the upper quadrant, the outside end of this coil being connected with the second upper commutator segment. Thus the connections would alternate, first with the upper part of the commutator, and next with the lower, until finally all the coils would be connected with the commutator. By tracing the path of the current in this case, it will be seen that if it passes through an upper coil it will next follow through a lower one, and then return to the second upper coil, from whence it will go to the second lower coil and return to the third upper, and from there to the third lower coil, and so on all the way around to the starting point.

In connecting an armature in this way, it is necessary to observe that if the number of coils in each division of the armature is the same, when we come around to the last coil it will be found that there is no end for it to connect with except the inside end of the coil next to it; and, although this connection would not disturb the electrical equilibrium, it would not be symmetrical, mechanically, and would lead to considerable confusion, especially

when repairs are to be made. To obviate this difficulty, and also for the purpose of rendering the connections uniform, in a mechanical sense, it is universally customary to leave out one coil in what would be the last section if we reckon from the point from which the connection with the commutator is commenced. Why it is necessary to resort to this expedient can be well understood from Fig. 2, in which the connections of an eight-pole armature are shown. The coils are reduced to thirty-two, which is at the rate of four to each pole, so as to simplify the connections, and for the same reason they are separated by a wide space. The full lines running from the coils to the commutator segments represent the outside ends, and the dotted lines the inside ends. Starting with the top coil, its outside end is connected with segment 1, its inside end 2 connects with segment 2, which, by solid line, connects with outside end 2 of a coil one-quarter of the circumference from the first coil—which is as it should be, there being eight poles. Inside end 3 of this coil connects with segment 3, and this segment with outside end 3 of the third coil. The inside end 4 of this coil connects with segment 4, which, by solid line, connects with the fourth coil. The inside end of this coil connects with the segment 5, which is just ahead of the starting-point. If the connections are followed out, around and around, until the segment marked 32 is reached, it will be found that the only place where the inside end of this can connect is with segment 1; and to do this, the connection would have to be made directly under the coil, instead of one-quarter of the circle ahead, as in all the other connections; but if the 32d coil is dropped, and also the 32d segment, the end of 31 that connects with this segment will go to the next one ahead, which is segment 1.

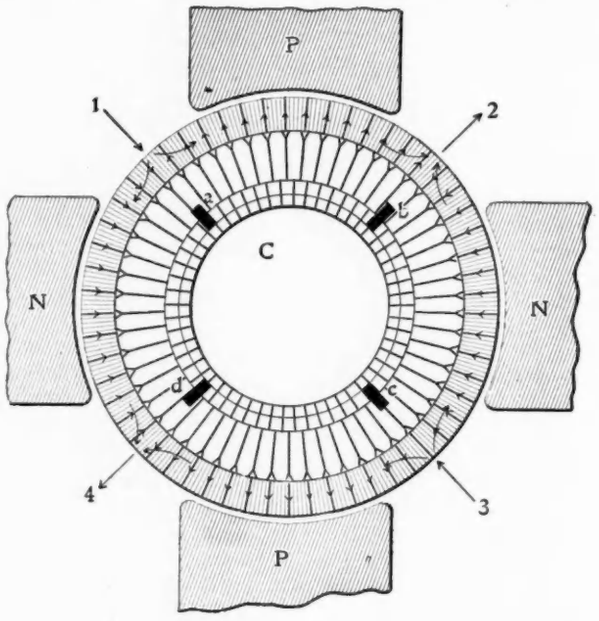


Fig. 1. MULTIPOLAR ARMATURE—PARALLEL CONNECTION.

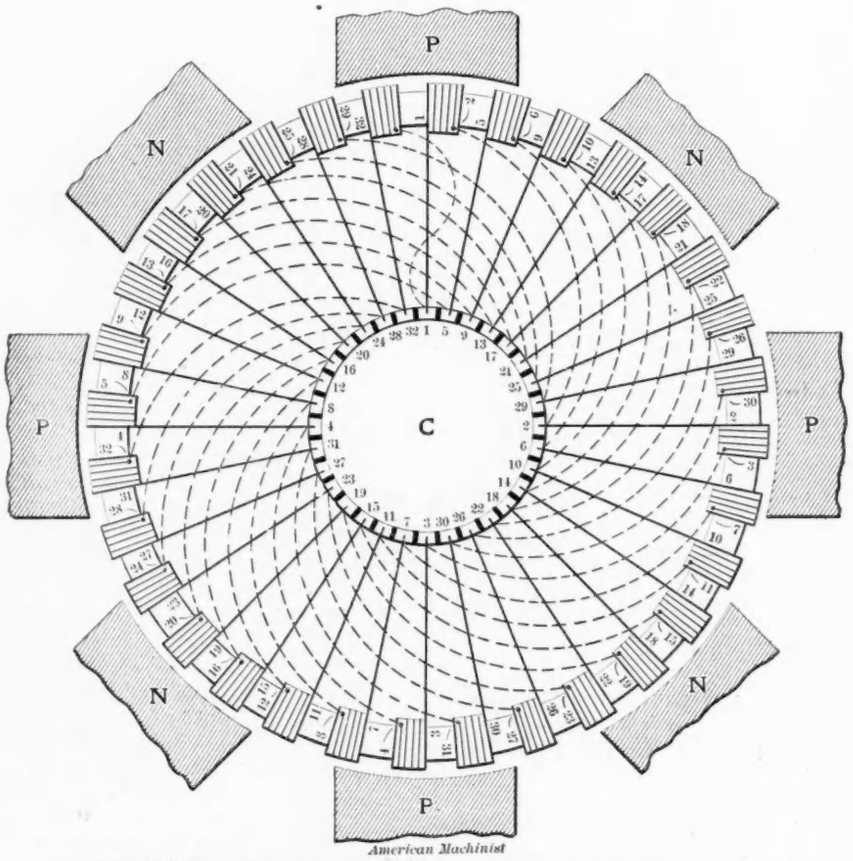


Fig. 2. MULTIPOLAR ARMATURE—SERIES CONNECTION.

With this style of winding, the brushes must be one-eighth of the circle apart. How to trace out the proper ends to connect in a damaged armature, with this style of winding, will be explained in another article.

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# Letters from Practical Men.

## Allowance for Press Fits.

Editor American Machinist:

In your issue of January 28th there is an interesting article on "Fits," and I think that a great many readers can learn a deal on this subject in regard to the allowance necessary to give a desired pressure. Since inside micrometers have become so cheap, a workman can readily tell what allowance he has given a crank pin or a driving or truck axle. When you say that a 4-inch axle turned .015 larger than the wheel bore can be put in place with a pressure of 30 tons, I think you are mistaken, and I am sure that every-day practice in locomotive shops will prove it. "Modern Machine Shop Practice," Rose, page 364, makes mention of a test to determine what amount of allowance was necessary, by Mr. Coleman Sellers, with the following result: If a wheel seat on an axle measuring 4⅞ inches diameter, 7 inches long, was turned .007 larger than the wheel bore, it would require a pressure of about 30 tons to force the wheel home. This, I am sure, is ordinary everyday practice. No doubt some of the readers of the "American Machinist" in the Baldwin or Schenectady shops, that have been fitting crank pins and driving axles in steel wheels, will be able to tell us something interesting in regard to what allowances are used (in this kind of work, and giving lengths and

diameters of fits) to get the pressures required. TERI.

[The figures which we gave were from a respectable source. Those of our present correspondent, it will be noticed, are a little less than one-half of what we gave. As we intimated, there are so many variable conditions that there is a possibility for a wide range of discrepancy. If we have a soft and open cast-iron hub and a wrought-iron shaft with rough-turning and not quite round on the one hand, while on the other we have the best of steel and of workmanship, it would not be surprising if a greater difference than this occurred. It is satisfactory to know that the latest facilities and the latest practice are far in advance and more general than was prevalent only a few years ago, and if our friends will favor us with up-to-date information in this line we will be glad to put it where it will do the most good.—Ed.]

▲ ▲ ▲

## Balancing Reciprocating Parts of Engines.

Editor American Machinist:

Two interesting letters to your paper, on the weights of reciprocating parts, by Mr. Griffin and Mr. Chas. T. Porter, are especially valuable as throwing light upon a subject recently presented to the Yorkshire Engineering Society, of England, by Mr. J. S. Raworth. Mr. Raworth states that high-speed, short-stroke, vertical engines of the Willans, Westinghouse, Belliss and "Universal" (designed by Mr. Raworth) type, usually operate very quietly. One of these engines—the Belliss—is double-acting. Mr. Raworth attributes this smooth running to inclosed crank cases and the extravagant lubrication obtained thereby. Mr. Porter and Mr. Griffin believe that smooth running can be obtained by proportioning the reciprocating parts so that the maximum pressure on crank pin due to inertia of these parts shall equal or slightly exceed the effective initial total pressure of steam on piston as the cranks pass their centers. Heretofore, sufficient weight of reciprocating parts with high enough speed has not been considered practicable.

I am of the opinion that the very short stroke, high-speed engine possesses this desirable feature—to wit, high inertia pressure with small weight of reciprocating parts. An investigation of the amount of maximum pressure on crank pin caused by inertia, shows that with a given piston speed and weight of reciprocating parts, the pressure varies directly as the number of revolutions.

The total maximum pressure on crank pins as they pass the centers due to inertia of reciprocating parts, equals the centrifugal force of a weight (equivalent to the total weight of these parts) supposed to be concentrated at crank-pin center, and making the same number of revolutions as the shaft.

If $W$ = total weight of all reciprocating parts in pounds,
$S$ = stroke of engine in feet,
$N$ = number of revolutions per minute;
then this centrifugal force will equal

$$\frac{W S N^2}{5866}.$$

If expressed in terms of piston speed, then, because stroke in feet equals $\frac{T}{2N}$, where $T$ equals piston speed in feet per minute, centrifugal force equals

$$\frac{W T N}{11722}.$$

Given four engines, each with 500 pounds weight of reciprocating parts, operating at 450 feet piston speed, making 75, 150, 300, 450 revolutions per minute, respectively, then the total pressure on crank pins becomes, respectively, nearly 1,500 pounds, 3,000 pounds, 6,000 pounds and 9,000 pounds. This shows how short stroke and high speeds develop inertia. A well-known instance of this lies in the fact that long-stroke Corliss engines, making 60 to 80 revolutions, require no counterbalancing—at same piston speed, a short-stroke, automatic engine requires excessive counterbalancing. In the former case the vibration is so slight that the bed plate readily absorbs it; in the latter it has to be absorbed in another way. In either case the actual counterbalancing weight to theoretically balance inertia of parts, if concentrated at crank pin, would be the same.

There is one phase of the question not considered by Mr. Griffin and Mr. Porter—to wit, the transfer of pressure from one slide to the opposite slide during the stroke. Slide knocks are sometimes the most difficult to prevent. If the piston and crosshead are being dragged or pushed—varying during the stroke—the pressure may be rapidly changed from one slide to the other, and is not confined to one slide entirely. This change of pressure, however, may be beneficial for lubrication.

J. B. STANWOOD,
The Technical School of Cincinnati.

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## Cast-Iron Lathe Spindles and Crosshead Pins.

Editor American Machinist:

Noticing your reference to a 48-inch lathe with a cast-iron spindle, reminds me of striking a job, thirty years ago, running a 72-inch lathe with cast-iron spindle and boxes. This lathe had been in use about half the time for at least ten years—probably longer—some of the time on work as large as it would swing, and some of the time on shafts no more than 6 inches or so in diameter. I used to think this lathe would turn the journals and fits of such shafts better than any lathe I had used up to that time. Not from necessity, but for purposes of observation, I hoisted the spindle out of its bearings. I was surprised at the almost absolutely perfect condition of both journals and boxes. There was scarcely evidence of wear anywhere, and no cutting whatsoever. I do not suppose this would be the case with many cast-iron boxes and spindles, but it was true of those.

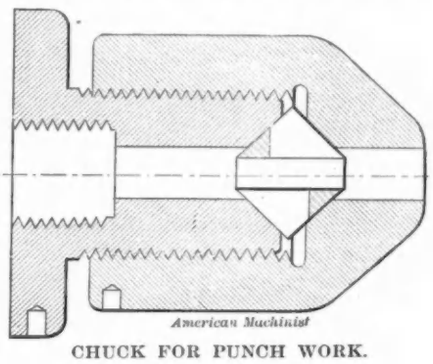
I know of at least one firm of steam engine builders who went from steel to cast-iron crosshead pins, some years since, because cast iron suited their purposes better. G.

▲ ▲ ▲

## A Chuck for Punch Work—A Broach—Broaching Gears.

Editor American Machinist:

I send you a cut of a chuck for punch work, or, in fact, any work from round stock that you wish to have run nice and




CHUCK FOR PUNCH WORK.

AN IMPROVED BROACH.

true, and that is too large for the regular split chucks of your small lathe. It would be of no use on screw-machine work, or any other piece-work; it is too slow. It is made of a solid piece of tool steel, is fitted onto the spindle of the lathe, and is operated by the long spanner shown in

the foreground. The boys call it the Pratt & Whitney chuck, as a part of the design was stolen from a similar chuck in use in their shops, but the double cone shown is, I think, original with us.

The design of the chuck is shown so clearly in the cut that it needs no description.

I am aware that some diemakers object to the use of round steel in punches, and, if wanted, a set of octagon bushings could be made to fit the sizes of steel in use.

The cost of the chuck, as made, was about $14. It would cost less if it could be bought outside, but as made in the shop, it comes under the head of "invisible costs," referred to in your editorial some time ago.

The second sketch is of a broach that is designed to cut a good chip, and still leave a smooth hole. I think, as a rule, a broach does not get a fair show; it is started in a hole, and then an irresistible force is put behind it, and it is bound to go through the hole, whether there is any cut to the thing or not. In the broach shown, the bulk of the stock is removed by the coarse teeth on the lower end of the tool; then the teeth on the upper end come into play, and the angle of the teeth being reversed, and also made very fine, it leaves a nice smooth hole.

I wonder no one has started the idea of broaching the teeth in gears and pinions. Make a set of dies, each one 1-32 smaller than the preceding, and then pile up your gear blanks and force them through. The first cost of the dies would be high, but once get a set done, and you could produce the gears as fast as a boy could take them away.

I am aware that this idea is a little wild, and I expect to get "called down" for it.

J. L. LUCAS.

## The Torque of the Triplex Pump.

Editor American Machinist:

I have made it a point to cultivate laziness all my life, and one form of it I have developed to pretty near perfection. I never do anything if I can help it; but when I do anything, I want to make it go as far as possible, and that is why I send you what follows. It is a kind of killing two birds with one stone. A friend occasionally imposes upon my laziness, and I recently received from him the following, which explains itself, or at least explains that it asks for an explanation. He says:

"I notice that where a pump is to be driven by transmitted power, and especially where an electric motor is employed, the single or double plunger pump has now been generally superseded by the triplex pump. I understand, of course, that the triplex pump is used in order to get a more uniform resistance or load on the driving shaft. Now, I would like to know how much advantage there is in using the triplex pump, over the single plunger or double-acting pump. I suppose it is quite a little work to figure this out; so, if I am asking too much, I hope no one will be offended."

I did my best for him in the way of an explanation. I know, of course, that the torque, or torsional resistance of the power pump, in its various forms, has been worked out over and over again by the pump people and others directly interested; but I do not remember to have seen the matter published, at least as regards the triplex pump, in such a way as would be available to mechanics in general; and as many of the readers of the "American Machinist" are doubtless interested as well as my personal correspondent, I venture to lay my work before them.

I cannot go into all the refinements of the case, but must present it in its simplest form. I assume that all the pumps at present to be considered are single-acting or plunger pumps, and we will have to do with only the working stroke. The return stroke of the pump, of course, takes some power, but we need not here have anything to do with that. The angular thrust of the connecting rod is also to be taken into account in a complete analysis of the case, but we may neglect this also, and assume here that the connecting rod is of infinite length, or that the resistance of the pump plunger is always in the same or parallel lines, and always at right angles to the axis of the driving shaft.

The operation will be readily understood by reference to the diagram, Fig. 1. We draw the semi-circle *A B C* of any convenient radius—the larger the better—divide it into sectors of 10 degrees each, and draw the several radii, 1, 2, 3, 4, etc. This gives us 18 sectors. As we intend to use the same diagram for single, duplex and triplex pumps, it is desirable, on account of the triplex, to have some number that is a multiple of three, and the number might be greater or less than I have selected. We now assume a certain length of line to represent the constant resistance of the pump plunger when doing its work. Say that the radius of the semi-circle is 5 inches; then we may assume for this line a length of 1 inch, and we then draw the several lines *a a a*, each of this length and all parallel with the diameter *A C*. Referring to sector 5, we next draw the line *c* parallel to the radius; then the tangent *t* and the line *i* parallel to the tangent. In this construction we now have the line *a* as the diagonal of the parallelogram *t c i r*, and the force or resistance represented by the line *a* is resolvable into the

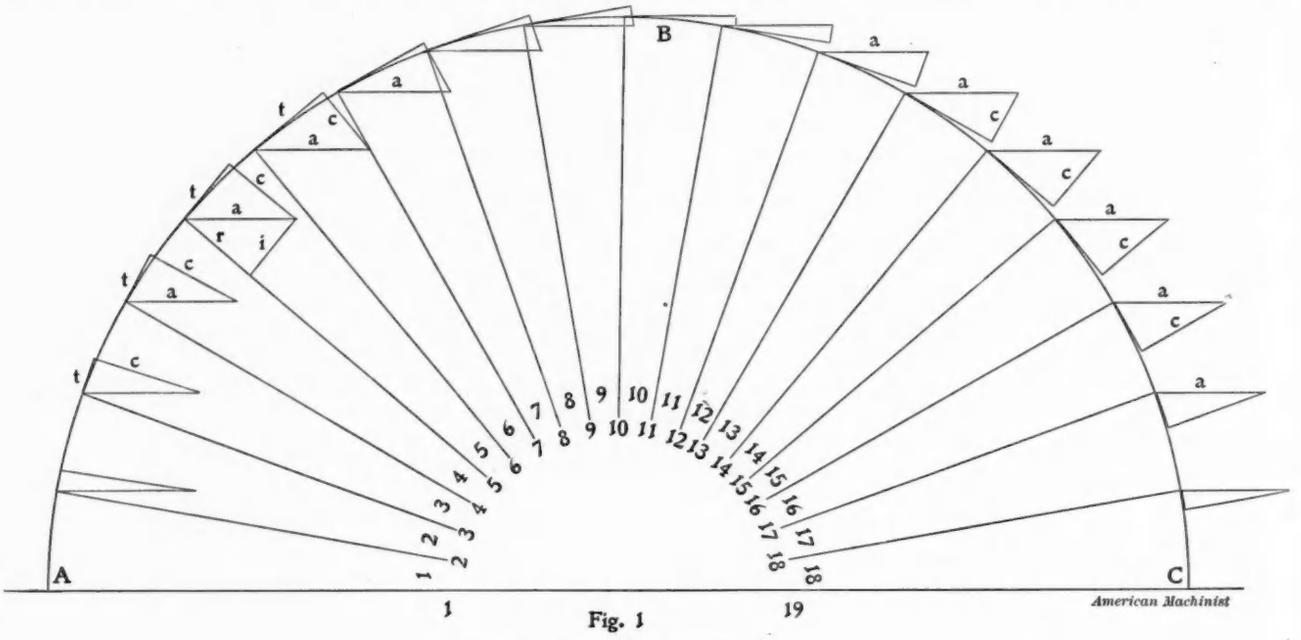



Fig. 1

DIAGRAM OF PUMP TORQUE.

forces represented in intensity and direction by the lines *t* and *c*. The line *t*, wherever it occurs in our diagram, represents by its length the relative intensity of the turning force required to overcome the pumping resistance of the plunger at that point of the revolution. It is not necessary, as will be seen, to draw the line *i*, and we have only done it in the one instance to complete the parallelogram, that the entire operation might be seen. We have now in the several lines *t t t* a representation of the tangent force required at each point of the half revolution of the crank when driving one plunger against a certain water pressure.

It is to be remembered that the equal sectors represent not equal distances traveled by the plunger, but equal angular distances traversed by the crank. When the torsional force required is low, as toward the ends of the stroke, the travel of the crank is proportionately greater for the distance traveled by the plunger, or rather the travel of the plunger is proportionately less for the same angle of revolution.

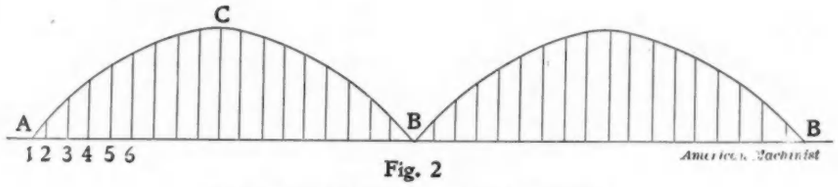



Fig. 2

TORQUE OF DOUBLE-ACTING PUMP.

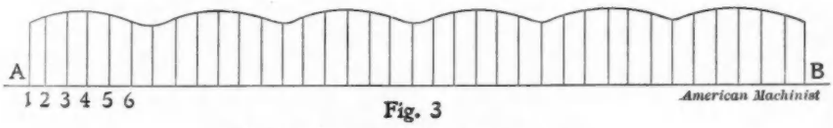



Fig. 3

TORQUE OF THE TRIPLEX PUMP.

Having now the several tangents *t t t* for the different angular positions of the crank, we proceed to get them together where we can see them all at once and realize their proper relation to each other. We draw the line *A B*, Fig. 2, and lay off 37 equidistant points, erecting at each point a perpendicular, thus forming 36 equal spaces, which may be taken to represent a complete revolution of the crank. We may number these perpendiculars to correspond with the numbers of the several radii in Fig. 1, and we then lay off upon each perpendicular the length of *t* for the corresponding radius, continuing the operation until the entire semi-circle from 1 to 19 has been traversed. Connecting these points by the continuous curve *A B C*, we have a graphic representation of the torque of a single plunger pump. If there are two plungers driven by cranks opposite, or at 180 degrees, the torque for the entire revolution is represented by continuing the previous operation for the other half revolution. The diagram would be equally correct for the two strokes of one double-acting piston. The torque for the second semi-revolution of the crank driving the single plunger would, of course, be only what was required to lift the plunger against more or less atmospheric pressure and to overcome the friction of the packing. The torque for the working stroke is about as bad as can be, being nothing at each end, very high in midstroke, and constantly fluctuating between these extremes, and it is not to be wondered at that a more equable distribution is sought.

The torque for the triplex pump is shown in Fig. 3, and it is evidently far preferable to the preceding. There is no dead center. The cranks are always driving either one plunger at or near midstroke, or two plungers whose combined torque is only a little greater, so that the fluctuations of the line, although frequent, are within a very narrow range.

The hights of the several perpendiculars in Fig. 3 are determined just as those in Fig. 2 were determined, only that the attention cannot be confined to a single crank. Beginning with No. 1, the crank in that position, being "on the center," finds no torsional resistance; but when one crank is at 1, another crank is at 13; and so we have *t* 13 for the length of the first perpendicular, *t* 2 + *t* 14 for the second, *t* 3 + *t* 15 for the third, and so on. When No. 7 is reached, the next crank ahead has finished its work, and the one crank works alone from No. 7 to No. 13, inclusive. There we have *t* 14 + *t* 2, *t* 15 + *t* 3, and so on continuously.

Figs. 2 and 3 are drawn to the same scale, and it will be noticed that the several perpendiculars in Fig. 3 are not as high as they should be if the entire values of *t* were taken from the diagram. They are, in fact, only two-thirds as high. I have assumed Fig. 2 entire and Fig. 3 to represent the torque of pumps of equal total capacity, so that for each separate plunger of the triplex pump the torque should be only two-thirds of that for the duplex or the double-acting pump.

St. Louis, Mo. CYRUS T. BROWN.

## A New Key.

A writer in "Engineering," London, suggests, for securing wheels to shafts, the styles of keys shown in the accompanying sketch, Fig. 1 being preferred. Referring to Fig. 1, the writer says: "The two 'flats' of the key should be parallel, and may be quite clear of the shaft and the boss of the wheel, but the four edges must be slightly tapered. By varying the angles of the edges, the tangential and radial forces (from driving the key) may be adjusted to any desired proportion." It is not stated that such keys are in use anywhere.

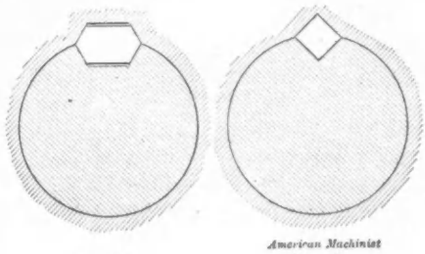



Fig. 1 Fig. 2

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## The Abingdon Thread.

Some time ago a prominent manufacturing establishment asked us for information about the Abingdon thread. We had to confess that this was a new thread to us, but we have been investigating, and now have a set of seven taps and dies of this system, which we have measured.

They were made, we think, in England, but by whom we do not know. They are very crude affairs, judged by our toolmaking standards, and seem to be intended to conform to the Whitworth thread so far as shape is concerned. The dies are marked as shown in the first column of the table below. The taps measure as shown in the second column, while their pitches are as shown in the third:

| Mark. | Diameter. | Pitch. |
|---|---|---|
| 16 G | .064″ | 56 |
| 15 " | .075″ | 56 |
| 14 " | .087″ | 64 |
| 13 " | .096″ | 60 |
| 12 " | .1″ | 46 |
| 11 " | .115″ | 48 |
| 10 " | .125″ | 42 |

These diameters are in each case a few thousandths larger than the corresponding gage numbers of the "British Imperial Standard Wire Gage," which became the legal standard in Great Britain in 1884.

The thread is supposed to have originated in the Abingdon Works, Birmingham, and is used to some extent on gun work. By this company it has also been applied to bicycle manufacture, and has been copied by others in England.

This thread seems to be little better than an example of how the addition of one needless gage leads to other things equally useless or worse. We cannot account for the curious variations of pitch, but suppose they just happened so.

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## A Professor's Idea of American Machinists.

Herr Von Meyenburg, a Swiss engineer, is making an extended tour through American shops, with a view to gathering information regarding our methods and products. At Worcester, Mass., he was interviewed by the reporter of a local paper, "the Gazette," with very interesting results. From this interview we present some extracts elsewhere. Following its publication, Professor Webster, of Clark University, sent a communication to the same paper, which has created some commotion among the mechanics of the town—which is about equivalent to saying all the inhabitants of the town.

Professor Webster makes the statement that "there are not in Worcester today five first-class mechanics," and as an illustration of what he means, asks—"How many men are there [in Worcester] who can cut a micrometer screw? How many men are there who can make a straight-edge, or who know how to build a machine to make one?" He follows this by the statement that "the amount of mathematics that is taught our engineering students is painfully small, and would be ridiculous in Germany"; instances the Niagara turbines as a combination of "American brute force and Swiss brains"; and states again that the "instruments of precision used in this country are built in Germany or Switzerland."

All of this is simply an illustration of the difference due to the point of view. The professor's remarks are as one-sided as are those of the self-vaunted practical man, whose chief delight is in sneering at theory. No man's opinions are of any value on subjects of which he knows nothing, and the sneers of the man who shouts "theory" as soon as someone proposes to apply a Fairbanks scale and the rule of three to a problem, find an exact antithesis in the views of a man who looks upon the construction of any machine—be it the Niagara Falls turbines or any other—as a mere matter of brute force.

We do not know how many Worcester mechanics can make straight-edges, but we do know that the finest plane surfaces on speculum metal for optical purposes, made anywhere, are an American product—a fact which is recognized by foreign as well as American physicists. Nor do we know how many American mechanics can make micrometer screws, but we do know that more of them are made and used here than in all the world beside. Micrometer calipers are distinctly an American product, and a representative tool of American machine-shop practice. If these tools are not considered sufficiently refined to be pertinent to the discussion, then we would refer to American-made dividing engines as being the peer of those made anywhere. It is not to be forgotten, too, that it was here that the manufacture of standard gages was first followed successfully, and that more such gages are in use in this country than in any other. It is well known also that the Lick and Yerkes telescopes are mounted according to American plans, and plans which are considered by astronomers to be superior to any made in the Old World, while in lenses, Clark in those for telescopes, and Tolles in those for microscopes, have long held the undisputed palm.

It is undoubtedly true, and we would be the last to deny it, that most of the laboratory apparatus of precision in use in this country is made in foreign lands, but we believe the reasons for it to be economic rather than mechanical. This is, in fact, demonstrated by the citations made, which show that work of the finest character is done here in large amount. Professor Webster is, in fact, conspicuously unfortunate in his illustrations.

We think our illustrations above may fairly be classed as precision work, but we regard it as an evidence of a narrow mind to refer to such work as the supreme test of mechanical excellence. Many of the greatest triumphs of modern engineering are embodied in machines which, from this point of view, are rough. The field of metallurgy is full of illustrations of this fact, while the man who does not feel like taking off his hat to the knot-tying feature of the self-binding reaper, made chiefly of rough castings, shows himself a mechanical Philistine. This last may be dismissed as a piece of "mere ingenuity," but what else is any meritorious piece of mathematical work? A beautiful mathematical demonstration is simply an *ingenious* demonstration, and only those who are both mechanicians and mathematicians know how closely akin are the methods of thought and the mental dexterity which are brought into play in solving the two classes of problems.

There are men who are unable to see any merit to the solution of a problem unless it is shrouded in mathematics, and such men are usually and naturally school men. It is part of the mental habit natural to the school atmosphere. The business of a student is to learn, and of the teacher to teach, methods, and it is but natural for this to lead gradually to a state of mind which puts the cart before the horse, forgets that the method is but the means to an end, and finally looks upon the method followed as of more importance than the end achieved. To the teacher this state of mind often becomes habitual, and most fresh graduates are imbued with it—to their loss, and not to their discredit. We believe we are safe in saying, however, that most graduates who enter commercial life get over it. We know but few such graduates of, say, ten years' standing, who have actually engaged in the design or production of machinery, who would agree with Professor Webster that too little attention is given to mathematics in American schools, and we regard the opinions of such men on the subject of more value than those of any teacher whose environment does not change. In our own opinion, however, the fault lies rather with the spirit of the teaching than with the amount taught. A stranger arriving at night in a strange city, may start out next morning on his errands by asking the nearest policeman for directions, and proceed in this way until he finally gets a working knowledge of the city; or he may buy a map and proceed by first locating himself and various landmarks, and so obtain at once a comprehensive idea of his surroundings. It is just so in studying mathematics, and there is altogether too much of the step-by-step, narrow-vision and close-view method fol-

lowed, and altogether too little of that broadly comprehensive method which makes the philosophy of the subject of the first importance.

Much of the discussion on both sides of the question of "theory and practice" is contributed by men of much knowledge but little wisdom, of much education but little judgment.

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A press dispatch says the complaints which have reached the Navy Department regarding the offensive attitude of Lieutenant-Commander Allibone, of the cruiser "Columbia," toward the men under him, have not been deemed by Secretary Herbert of sufficient gravity to lead to a court-martial, and in a letter to the officer, the Secretary has expressed his determination to take no further action in the present instance. We have some curiosity to know what would be considered of "sufficient gravity" to secure attention when the brutal conduct of a line officer is in question. We happen to know of at least one warrant officer who left the "Columbia" because he found the brutal treatment meted out by Lieutenant-Commander Allibone to those under him simply unbearable.

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Professor Hatt, of Purdue University, has forwarded us a copy of an extremely interesting letter written by Mr. Eaton Hodgkinson in 1850, which was found under peculiar circumstances. Professor Hatt recently obtained from a London second-hand book store a copy of Hodgkinson's "Treatise on the Strength of Cast Iron," published in 1846, and found this letter between the leaves. It is addressed to —— Michalls, Esq., and Wm. Kay, Esq., and is a report on a broken engine crank pin. It points out certain flaws in the pin, and also, by comparison with similar pins made by Watt and Fairbairn, shows it to be small for its duty.

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## Questions and Answers.

**Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.**

(26) W. H. O., York, Pa., asks: What is the best glue, cement or composition to make emery cloth adhere to polishing plates made of cast iron? A.—Many things are suggested for this purpose, but unfortunately we are not so situated as to be able to say from experience which is best. Paint the cast iron with white lead, and when it is dry and hard use best Russian glue dissolved in water with a little vinegar or acetic acid.

(27) G. S. S., Salem, Mass., asks: In the ignition of gas or oil vapor, or the explosion of gunpowder in a closed vessel, is the pressure produced a permanent one, or only instantaneous and then dying away to nothing? A.—The pressure is a "permanent" one, or at least as much so as the steam pressure in a steam engine. Indicator diagrams taken from gas engines show that the engine is not driven by the direct act of the explosion, but by the gradual expansion of the gas throughout the stroke succeeding the explosion.

(28) T. H., Lampasas, Tex., asks: Can you tell me some way to blue steel without heating it hot enough to start the colors or using acids that will injure the steel? A.—We certainly cannot. If steel is blued by heat, the colors must run down through all the range of temper colors, from the light yellow, red, etc., until the blue is reached; and if the steel is hard at the beginning, its temper will be lowered correspondingly with the color. The following mixture is used for coloring highly finished parts of gun work: Lead acitate, 50 grains; sodium thiosulphate, 50 grains; water, 5 fluid ounces. The mixture is to be heated and the article is to be entirely immersed in it, when it will change color gradually, becoming first a light brown and then, successively, darker brown, purple and blue gradually becoming lighter, light blue, steel gray, and finally black, after an immersion of half an hour. Some experimenting will be required to use it successfully.

(29) Steel Works, Pittsburgh, Pa., asks for a practical rule for the size of supply pipe for the cylinders of hydraulic hoists. A.—Practice is quite divergent, owing to the great variety of conditions. In some experiments, a pipe area of 1-150 part of the ram was found to give a ram speed of 15 feet per minute with 600 pounds pressure, and a speed of 25 feet with 1,200 pounds pressure. With a pressure of 1,000 pounds, a pipe diameter of 1-100 to 1-150 of the ram fulfills ordinary requirements of speed when the water discharges through another pipe. Where the same pipe is used for admission and discharge, a pipe diameter of 1-30 to 1-50 of the ram is necessary to give reasonable speed to the return movement. Some designers habitually allow an excess of 40 or 50 per cent. in the size of the ram over that actually required to lift the load, in order to provide sufficient difference in pressure at the two ends of the pipe to provide a prompt movement. With your ram of 6 inches diameter and pressure of 300 pounds, we would use ⅜-inch pipe, if the same pipe is to act both for admission and discharge.

(30) W. R., Philadelphia, asks for instructions for making blueprints. A.—The following proportions give as good results as any which we have seen:

First solution—
- ½ ounce red prussiate of potash.
- 3¼ ounces water.

Second solution—
- ¾ ounce citrate of iron and ammonium.
- 3¼ ounces water.

For the coating solution mix in equal parts. Apply with a camel's hair brush similar to those used with press copy books. Apply freely, but not so freely as to have the solution stand in puddles. The paper should dry hanging by its edge, in order to drain off superfluous solution, and should be so far as possible non-absorbant. The chemicals should be bought in original packages to insure their being fresh, and the citrate should be kept in a tin box, or otherwise in absolute darkness. Especially and particularly, absolute cleanliness must be observed. A brush on which the solution has been allowed to dry exposed to the sun is ruined for all time. Immediately after use, the brush should be rinsed repeatedly, until there is no show of solution in the water.

## Personal.

Prof. Simon Newcomb has been detached from the Naval Observatory.

Chas. Davis, of Cincinnati, sailed on the 24th ult. for Europe, on a business trip.

Chief Engineer G. E. Tower, United States Navy, is placed on the retired list.

Chief Engineers G. Cowle of the "Puritan," and J. P. Mickley of the "Terror," exchange places.

M. Morton, of the Morton Manufacturing Company, sailed on the 27th ult. for Europe, on a business trip.

By the dissolution of the Steel Board, Passed Assistant Engineer E. R. Freeman, United States Navy, returns to the Bureau of Steam Engineering, Washington.

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### Some Inside History of the Late Rail Trust.

"Locomotive Engineering" for March prints some very interesting news about the late steel rail trust. This trust, it seems, was proposed and practically directed by the late President Roberts, of the Pennsylvania road, mainly, at first, because most of the leading rail-making establishments were located on that road and contributed to its freight receipts.

Our contemporary, whose authority is a man whose identity is very thinly concealed by the words "head of the largest steel-making company in the country," concludes its article as follows:

"Since the beginning of Mr. Roberts' illness, the trust has been without a guiding head, and there has been a good deal of discord. Mr. Sloan [President of the D., L. & W. R. R.], one of the presidents who helped establish the trust, gave it a blow which ended in dissolution. He wanted to buy rails, but refused to pay $25 per ton for them to the Scranton people. The president of the Scranton company was firm in refusing to break the trust price, and Mr. Sloan applied to President Gates, of the Illinois Steel Company, who did not show so much firmness. President Gates went to Pittsburg and had an interview with President Frick, of the Carnegie Steel Works, and wanted to cut prices, but could not obtain permission to do so. On returning to Chicago, he called a meeting of the directors of the Illinois Steel Company, and they agreed to leave the business to the judgment of their president, and he then agreed to sell under the trust prices. The Carnegie people at once quoted lower prices than ever steel rails had been sold for, and the trust was dead.

"Since the trust was formed, there have been great improvements effected in the steel-making business, and the cost has been greatly reduced where the most modern furnaces, machinery and processes have been introduced. Two or three

of the steel makers have devoted part of their incomes to betterment of their plants, but others have done little or nothing to improve their facilities; consequently, there are several rolling mills which can sell rails at profit at a price which will ruin the others. Unless some new kind of arrangement can be fixed up, about three of the six remaining steel mills will close up as soon as the heavy demand for steel rails ceases and the era of competition returns. About 800,000 tons of rails have been contracted for under the cut prices, which is two-thirds of the entire output of last year."

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## American Machine Tools and Other Products as Seen Through Foreign Eyes.

Below we give the substance of the remarks of Herr Von Meyenburg, at his interview with the reporter of the "Worcester Gazette," referred to in another column:

"My object in coming to this country is to buy machinery and to thoroughly investigate the design and construction of American machine-making tools. In machine-tool construction America beats the world. The finest lathes, planers and all tools used in the manufacture of other machines can be bought in this country. Foreign manufacturers are beginning to realize this and to buy largely in this country. But, on the other hand, the machines and engines which are made with the American labor and with the American tools are vastly inferior to those made in Europe. Some of your finest engines, dynamos and other machines would not hold a place in the German or Switzerland market any time at all. Your tools are better, but the machines are inferior."

When asked how he explained this he said: "It is partly due to the labor, and partly to the men in charge. Labor is so costly here that for the same money you cannot get out equally good machines. You make them too fast, and the finish and construction are not so fine nor so accurate. Then, too, your foremen and master mechanics do not get the training that ours do. I do not want to criticise any one American mechanical school, for they are all alike. A student goes through a course of four years, and then is ready to take up his work. In the meantime he has been given a general course in theory, and, in addition, has had a smattering of the practical work. A little blacksmithing, a little lathe work, a little welding and a little something else. None of it is complete. In our schools we have a four-year course in theory. During that time we do not have a bit of work in the shop, but we study the theory very carefully. We are made to think, instead of gathering a mass of tables and figures in our heads indiscriminately. At the end of the four years we go into the shop and have two years' work there. Then we are ready to take a position.

"As a result, the German master mechanics have a tremendous amount of knowledge, and the power to apply it in special cases. But we lack the common sense and personal energy that you have in this country. You have the common sense and quick-wittedness, but lack the knowledge of the great principles. It is not the teachers' fault. You have fine teachers here; but the Americans don't want to learn; they don't think. They would rather 'sport,' I think you call it. You don't learn the languages carefully. You think that America beats the world in everything, and that there is no need of studying foreign methods. Now, there are some excellent things in Germany, which can be found out only by reading the original description in German. To be sure, your mechanical papers print translations, but in many cases they are entirely wrong. I call to mind an article about a German turbine wheel, which was recently printed in your finest engineering paper. Even that paper told of the water as coming from the bottom instead of the top, and stated that the greatest horse-power developed was 200, instead of 1,500. That illustrates the case. You must read the originals.

"The reason why American tools are better, while the better machines made with them are found in Europe, is this: Machine-making tools do not involve the great principles that engines, dynamos and great machines do. Tools are really evolved.

"If a piece is found by experience to be too small, it is made heavier next time. Tools start at a simple stage, and are gradually evolved, step by step. You, in this country, apply your common sense and make the changes as a matter of course, and without much thought; while a German would spend a long time in figuring out the why and wherefore, and would be distanced by his American competitor. In the greater tasks, however, thorough and complete knowledge of the great principle is necessary.

"Manufacturing interests are greatly on the increase in Europe, and machine tools are being bought in great quantities. It is a great opportunity for the American manufacturers of tools, for the European market cannot supply the demand, and the European manufacturer prefers the American product if he can get it. The American goods are being exported largely, and that is what keeps your machine-tool shops so busy in the general dullness of trade. The opportunity may not last forever, though, for some time we will get the required common sense, and when we do, our machine tools will be better than yours."

[We have, before this, expressed the opinion in these columns, that the isolation of this country works greatly to its disadvantage industrially. It raises a tremendous barrier which prevents accurate knowledge of what the rest of the world is doing, and this state of ignorance greatly favors that spirit of buncombe for which we are, justly or unjustly, noted. Our equally well-known desire to know what foreigners think of us, is a partial help in this direction, and when a foreign engineer shows the candor of Herr Von Meyenburg, in acknowledging our superiority in one direction, it is impossible not to give him credit for equal sincerity in all else that he says, and we are far from claiming that there is not a good deal of truth in his remarks. The neglect of the study of modern languages in the schools of this country is, as a matter of fact, shameful, and no one can doubt that the plan of instruction which gives two entire years to shop work, will, in the average case, accomplish far better results than the usual work in the college shop. Our own belief, as is well known, is that this shop work should precede rather than follow the college work, but this is of minor importance after all, and we think that, could statistics be gathered, the number of American graduates who take a term in the shop, would be found larger than is usually believed.

It is, perhaps, true that in what Herr Von Meyenburg calls the "greater tasks," such as the design of the Niagara Falls turbines, for example, the European has the advantage of us, but we do not consider that these cut so large a figure as he seems to think. In our opinion, about ninety-nine per cent. of the mechanical work of the world includes as much the greater item involved in its construction, that same process of evolution and application of common sense that he attributes to machine-tool work. Moreover, while the glory goes with the greater tasks, they are not the ones which provide much work for the shop or fill the cash box.

Moreover, we must doubt if his expectations regarding the growth of his countrymen in common sense will be largely realized. Nothing is so difficult for the individual as to change his habit of thought, while for a nation to do so it is a thousandfold more so. These things are matters of inheritance, of habit and of surroundings—in short, of environment—and if (of which we are not so sure as Herr Van Meyenburg) we excel in the quality of common sense, it is a condition which, in our opinion, will last for many years.

We would not in the least detract from or minimize the thoughtful and courteous words quoted, as we believe that such expressions of opinion work only for good. No one who is aware of the tremendous industrial progress of the German people during the past twenty years can doubt their capacity for still further progress, and especially we believe that what this nation most needs is the man or the paper which shall call attention to its shortcomings rather than glorify its excellences, and if such a voice seems sometimes very much like that of one crying

in the wilderness, it is only so much more evidence that the voice is filling the mission of a prophet and a seer.—Ed.]

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A correspondent calls attention to the fact that we mentioned the late David Kirkaldy as an "English engineer," whereas the fact is that he was a Scotch engineer, having been born in Dundee, Scotland.

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The manufacturers of steel balls for bearings are said to have all the business they can handle; a number of them are reported as having contracts that will keep their plants running all the present year and into 1898.

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The Tiona Oil Company, of Cleveland, O., has a new excuse for having a great many barrels of oil scattered around over the country which cannot be delivered. They are now charging it to a "mistake of our shipping clerk," and their letters are being sent to us by our friends, who evidently consider this to be simply a variation of the old swindle.

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Mr. Louis Sholes, of Milwaukee, Wis., son of C. Latham Sholes, the original inventor of the Remington typewriter, has perfected a machine somewhat similar to his father's invention, but so arranged that all parts of a letter that has been written remain in plain sight of the operator This, of course, involves an entire re-arrangement of the mechanism, and the abandonment of the basket type of construction.

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The Arbuckles have a machine for putting up coffee in two pound packages. It puts up 30,000 packages in twenty-four hours, or at the rate of nearly 21 packages per minute. Its work is equal to that of 200 persons working twelve hours per day and putting up a package in three minutes. The machine, with attendance, does the work cheaper than any human labor on earth, and we may fairly suppose that every cup of coffee is the cheaper for it.

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A remarkable and rather sudden increase in the length of transatlantic steamships is a feature of present development. No sooner does the "Pennsylvania," 600 feet long, arrive here on her maiden voyage than it is announced that one still longer is to be constructed; this last to be the "Oceanic," 704 feet long. The first named vessel is designed chiefly for freight, and took out what is said to be the largest single cargo ever shipped from this port, over 18,500 tons measurement. This cargo would have loaded about 616 ordinary freight cars. The "Oceanic" will be for passenger service, and is expected to be able to make the voyage in the uniform time of six days, regardless of weather. She will be about twenty-seven feet longer than the "Great Eastern," but will not be so wide nor so deep.

# Commercial Review.

NEW YORK, SATURDAY EVENING, FEB. 27TH.

STEAM POWER MACHINERY.

The present outlook in steam engines is not inconsistent with the year yet proving itself a good one. But nevertheless, the continued shyness of buyers tends to the conclusion that for the interval between the present time and that in which the quieting influences of hot weather will be operative, extravagant results should not be anticipated. So far as actual sales are concerned, the month of February in the New York engine market has been a conservative one. Of prospective business, considerable is, indeed, in sight. Whether prospects are brightening or darkening is a matter upon which radically different views are entertained, but at least it may be said, that a fair proportion of the trade are hopeful. There are some who see signs of improvement in engines for electric lighting, though unfortunately certain of the leading concerns who deal in them are not self-congratulatory over the present state of affairs. The representative of one of the largest companies manufacturing a type of Corliss engines believes that there is an increasing demand for machines of that class to drive large, slow, direct-connected alternating dynamos for street-railway purposes, etc.

An example of price cutting and the reward which awaits the most ruthless cutter, is found in the bids on a local pump contract. They included sums about as follows: $2,500, $2,100, $2,050, $1,500. The last mentioned was accepted. One of our friends, who represents a company manufacturing steam separators and feed water heaters, remarked yesterday, having heard a report that an advance in certain steam pumps is talked of, and said that he was considering the advisability of doing likewise with his own goods. A question or two, however, brought out the qualification that the contemplated increases are not likely to be made in either case until there is a demand which goes farther to justify them than the present one. So, after all, the parties appear to show admirable discretion.

Is there not something worthy of imitation by all manufacturers who can possibly afford the capital to do so, in the policy pursued by prominent oil refineries, in utilizing periods of dullness to put their plants in shape for times of activity? Thus they are prepared to avail themselves of the new work as soon as it comes, and do not lose the benefit thereof by being forced then to make long delayed repairs and improvements.

One comparatively recent piece of engine work which may be of interest to note is found on the two new twin screw, double-decked ferry boats of the Pennsylvania Railroad which have just been constructed, one by the Cramps and the other by Hillman, to run between Twenty-third street, N. Y., and Jersey City. They

(Continued on page 36.)

# Business Specials.

**Transient Advertisements 40 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.**

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Engine Castings ⅛ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Send $1 to the Tabor Mfg. Co., Elizabeth, N. J., for improved stop-motion revolution counter.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

For Sale—Patent on combination bicycle stand; cast, malleable or wrought iron. The best article yet invented. A. J. De Mers, Batavia, N. Y.

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# Wants.

**Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.**

## Situations Wanted.

Experienced mech. draftsman wants position soon. Address Box 95, AMERICAN MACHINIST.

Foundry Foreman, has considerable experience, is open for position. Box 72, AMER. MACHINIST.

Compt. draftsman wants position; exp. in designing engs., boilers, gen'l machy. E. P., AM. MACH.

Draftsman, first class, exp. in wkn. drns. desires pos. with tech. constn. concerns. Box 94, AM. MACH.

D'ftsman, exp. in shop, drawing room, gen., power transm. mach. wants position. Box 104, AM. MACH.

Sit. abroad, good mach., designer auto. tools, etc. Ref. past and pres. emp.; age 26. Box 101, AM. MACH.

Situation Wanted—Draftsman; a first-class man, thoroughly trained in the design, construction and operation of machinery. Box 100, AM. MACH.

Draftsman, mechanical engineer, designer of stationary and marine, gas, gasoline and kerosene oil engines, wants position. Box 105, AM. MACH.

Draftsman, tech. educa., 6 years shop exp., 3 yrs. as master mechanic, wants position as designer on spec., auto. and exp'm'tal work. Box 99, AM. MACH.

Wanted—Position as gen. foreman or supt.; am thoroughly posted on get'g up spec. or gen. mach.; high speed steam or gas engs. Box 108, AM. MACH.

A tool maker, with a thorough tech. education and several years experience at designing special machinery and tools, wants a position as supt. or general foreman. Age 39. Box 89, AM. MACH.

Wanted—A position as foundry foreman; 20 years experience, both foreman and first-class moulder on light and heavy machinery. A hustler; best of references. Address Box 87, AM. MACH.

Young engineer, speaking English, German, Russian and French, desires to represent some American manufacturer in Europe. A1 references as to ability and character. Box 90, AM. MACHINIST.

Wanted—Position as foreman of brass foundry; have had long experience in engineers, plumbing and electric supplys; best judgment used in handling men and material. Address Electric, AM. MACH.

Wanted—Position as foreman pattern maker; 34 years; now in charge; practical d'ftsman; exp. in hoisting and mfg. mach. and arch. work; west of Mo. River or Mexico preferred. Box 111, AM. MACH.

Mechanical engineer, 25 years exp. as d'ftsman, foreman and supt. on gen. and special mach. and buildings, wants suitable pos. Chicago preferred. Best ref. Box 1074, N. Francisco Av., Chicago.

Gas Engines—Thorough all round machinist, 2 years with one of the best builders, will construct engines that in efficiency and design equal any on the market. Investigate, good thing. 109, AM. MACH.

Wish position as designer or assistant superintendent. Have had technical education, with 10 yrs. shop and drawing room exp. Gas engines and gearing thoroughly understood. Box 107, AM. MACH.

Wanted—Change of position—12 years experience as machinist, tool maker, draftsman and superintendent. Now in charge of a prominent dividend paying shop; age 30. Good ref. as to character and ability. Address Box 85, AM. MACH.

are fitted, each, with tandem compound Ideal lighting engines to drive, by direct connections, 25 kilowatt multipolar dynamos. Mr. W. R. Fleming, agent for the Ideal engines, states that those of this type in marine work are somewhat a novelty. When used on a ferryboat they have to be capable of running condensing or non-condensing at almost any pressure of steam.

Some improvements in Bellevue Hospital having been decided upon and contracted for with Baker, Smith & Co., bids closed to-day for a part of the sub-contract work, including six boilers of 150 horse-power each, particularly for heating purposes, beside a steel plate chimney and other heating apparatus.

We have obtained several reports from steam boiler and pump interests. Of the latter certain companies can tell of a brightening horizon, though it is hardly probable that pumps are upon a status essentially different from that of engines. While we are not able to give a direct opinion from either of the two largest of the companies, as to present office business, it may be said that one of them has lately taken several good-sized water works contracts, viz.: Those for the cities of Chicago, Brooklyn and Baltimore, which together foot up to something like a million of dollars. Two smaller water works projects, the orders for which, we understand, are about to be given out, are those for Asbury Park, N. J., and Perth Amboy, N. J. The number of water works enterprises now in progress or in immediate prospect is not, however, especially large.

Boilers evince much the same commercial characteristics as engines. On the sanguine side of the subject may be quoted the Abendroth & Root Company, whose business for the last three weeks has improved. They are running with full force and on full time, comfortably busy but not driven. They think, however, that, from the appearance of present substantial inquiry, there is prospect that by the end of another month they will be forced to hustle. Orders have recently come from several manufacturing establishments. They find

EXPORT TRADE

in boilers quiet, but during the course of February they have had six large foreign orders for pipe. It is commonly reported by the trade that export orders are not indeed coming in readily at the present time.

The Ames Iron Works yesterday closed another contract for purposes in the Far East. This time it is for three 80-horse power automatic engines intended to drive belt connected arc-lighting dynamos, for shipment to Singapore.

The Westinghouse Machine Company have received an order from the International Electric Company, of Liege, Belgium, for three compound engines of

(Continued on page 37.)

A skilled designer and builder of special machy. is open for engagement; many yrs. exp. in originating and perfecting automatic machy. and improving mfg. processes; highest ref., covering entire record. Address Box 65, AMER. MACHINIST.

Position wanted as supt. or eng. by a thoroughly competent mech. Exp. covers engine building, gen. and special mach. work, also design and construction of tubular and firebox boilers; 15 years in similar positions; age 38. Ad. Box 106, AM. MACH.

Address Box 86 AMERICAN MACHINIST if you want a man who has served time as machinist, draftsman and supt., age 30, experi'd in designing and building steam, elec. and gen'l mach'y and tools. At pres. supt. of a large and prosperous shop. Good reason for changing. Ref. as to abil. and integrity.

## Help Wanted.

Help Wanted—Good pay for leisure hours. Geo. W. Lord, Philadelphia, Pa.

Wanted—Job foreman on mill. machs. and planers on strictly first-class work. Box 96, AM. MACH.

Wanted—A first-class die sinker; steady work to the right man. Address Box 757, Worcester, Mass.

Wanted—Experienced gas engine man to go on the road. Address Box 102, AMERICAN MACHINIST.

Wanted—First class machinist for light and heavy work. Rushmore Dynamo Works, 24 Morris St., Jersey City, N. J.

Wanted—Number one foundry foreman, who understands melting iron and best way of getting out castings, modern shop. Pig Iron, AM. MACH.

Wanted—Foreman for tool room emp'ing 25 men, on strictly high grade wk; 2 first class all around tool mkrs. Wks. locat. E. Mass. Box 97, AM. MACH.

Wanted—Two energetic, exp. d'ftsmen on experimental shoe mach. and strictly first-class special tool and fixture work. None but those having worked in shop need apply. Box 98, AM. MACH.

Wanted—A machinist and a boiler maker who can each invest $3,000 to $5,000 in a company doing a good foundry, machine and boiler business, located in Western New York, to take charge of machine and boiler departments. Box 103 AM. MACH.

Chance for a Good Man—A large bicycle mfg. co. wishes to secure services of first-class mechanic as asst. supt. To an energetic, exp., thoro'ly capable young man with exec. abil., excep. oppor. is offered. All communications confiden. Address with ref., stating salary required, A. B. C., care AM. MACH.

Wanted in Ohio—Thoroughly competent man to take charge of die department employing about 25 hands on general line of dies for sheet metals. None but those with executive ability and push, and thoroughly competent need apply. Address with full particulars as to experience, salary expected, etc. Box 110, AMERICAN MACHINIST.

▲ ▲ ▲

## Miscellaneous Wants.

**Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.**

Cheap 2d h'd lathes & planers. S.M.York,Clev'd.O.

Calipers & Gauges. F.A.Welles, Milwaukee,Wis.

Draftsmen's new conveniencies. D. J. Kelsey, New Haven, Conn.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses,engine lathes & planers. Dietz, Schumacher & Boye,Cincinnati,O.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., of Spring and Varick streets, New York City.

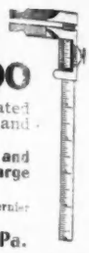
We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offered to inventors.

Wanted—An active partn'r with $10,000 or $15,000, to take half interest in mfg. bus., estab. for 15 yrs. and now having a world-wide reputa. A thorough mechanic preferred. Exceptionally good inducements offered. Ad. Lock Box 805, Bridgeport, Conn.

Wanted Tools—Prices on following tools for a new machine shop: 1 planer, 24" to 34" x 6' to 8'; 1 lathe, 30" to 36" x 18' between centers; 1 lathe, 16" to 20" x 10' between centers; 1 drill press, back geared 20" to 25" to center; 2 bench vises, 1 blower for blacksmith's fire, new or second hand, but in good order. Henry Ehrensperger, Box 253, De Pere, Wis.

SAVE MONEY AND BUY
A $2.50 CALIPER
NOW $2.00



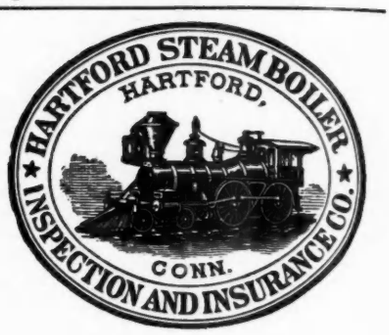
It has 1¼ in. hardened jaws, graduated in 16ths with Vernier to read 64ths and 128ths, inside and outside.

**You put this Caliper over your work and you know in an instant how much too large or too small. SEE?**

Made in five sizes, any graduation, Metric and Vernier Systems. Ask your dealer for them.

**E. G. SMITH, Columbia, Pa.**

**Wanted** Catalogues and addresses of makers of the most improved Bicycle Tools, by Schuchardt & Schütte, Berlin C., Germany, Largest Importers of American Machine Tools in Europe. Refer to any large Machine Builder in America.




**J. M. ALLEN, President.**
**WM. B. FRANKLIN, Vice-President.**
**F. B. ALLEN, Second Vice-President.**
**J. B. PIERCE, Secretary and Treasurer.**

"Tricks of the Trade"

There's a new 400-page, cloth-bound book, just published, on machine shop practice. It is indispensable to every machinist, and it has been given the appropriate name of

"SHOP KINKS"

by ROBERT GRIMSHAW. It isn't like any other book on the subject. It shows special ways of doing work better, quicker, and cheaper than usual. It is full of pointers as to how work is done in the best American and European shops. It bristles with valuable wrinkles and helpful suggestions. It will benefit all, from apprentice to proprietor. Every machinist, at any age, should study its pages. It contains 222 illustrations, most of them directly contributed by eminent constructors. Every machinist needs it.

**PRICE, $2.50.**

*** Copies prepaid on receipt of price.*

Send for circular of the above book also of recently published books, and our large catalogue of books for machinists and engineers, electricians, etc., etc.

**HOW TO SEND MONEY.**—Remit by Postal Order, Express Order, Registered Letter or by Draft on New York.

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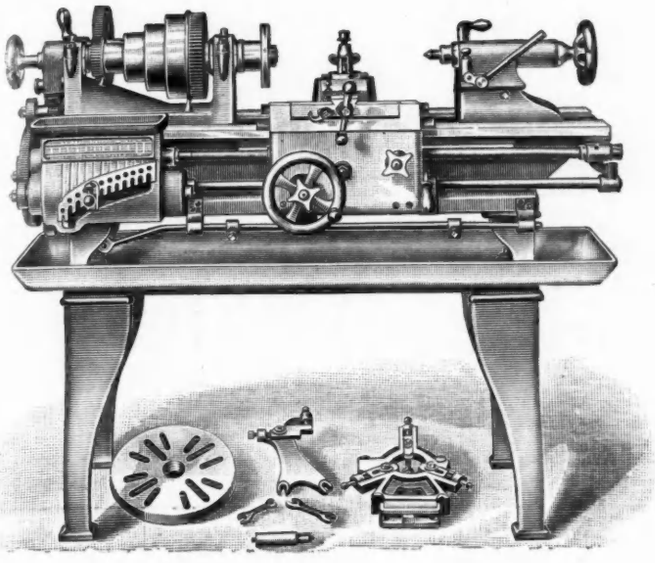
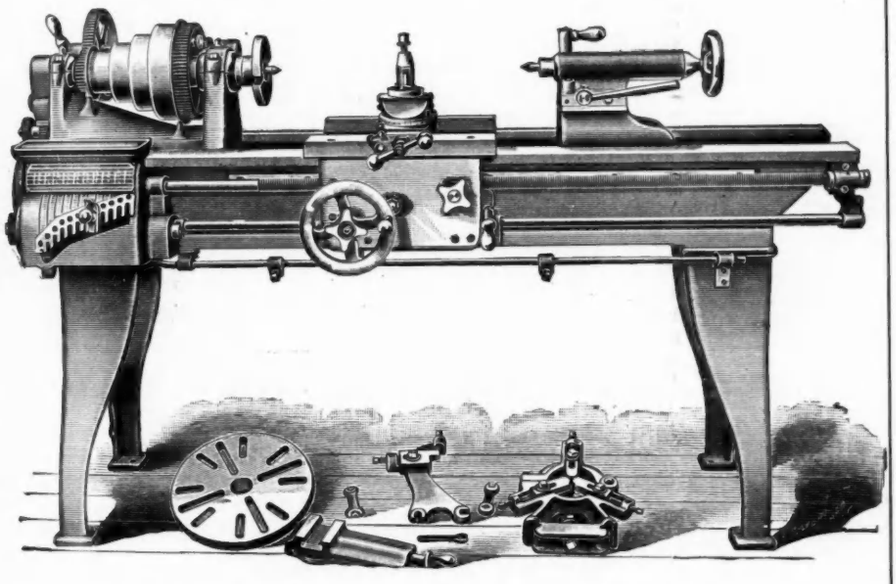
**NORMAN W. HENLEY & CO.**
PUBLISHERS,
15 Beekman Street, NEW YORK.



12" Hendey-Norton Lathe

is fitted with drawing-in sleeve and American Watch Tool Co's standard chuck, used in making small taps, reamers, etc. Work finished first and cut from bar afterwards. No centering required. See carriage reverse lever by right-hand side of apron; no reaching for countershaft shipper required.



14" x 6' Hendey-Norton Lathe.

These lathes are modern, high-grade, practical tools, and are specially adapted for tool-room work. They have the Norton Attachment for screw cutting, giving 36 different threads and 36 different feeds with only two changes of gear and movement of lever in gear-box from one notch to the other. Note the automatic stop under apron. It will automatically stop carriage at any desired point in either direction; invaluable for internal or duplicate work. SEND FOR CATALOGUE.

The Hendey Machine Company,
Torrington, Conn.

Agents for the Pacific Coast, Pacific Tool & Supply Co., San Francisco, Cal.

European Agents: { Chas. Churchill & Co., London and Birmingham, Eng.
Schuchardt & Schutte, Berlin and Vienna.
Eugen Soller, Basel, Switzerland.

(Continued from page 36.)

300 horse-power each, and one of 100 horse-power. They had in the past made a sale to the same company.

Rumor hath it, that a party is quietly figuring on twenty stone crushing outfits, each including engine, boiler, etc., for shipment to Africa. The contract should be worth $60,000 or $80,000.

Mr. E. H. Allen, Hawaiian Consul-General of New York, has been authorized to ask for proposals on 4,140 feet of 12-inch cast-iron water pipe, special castings and pig lead for his Government. Bids are asked from Americans only, and are open at his office until March 15th.

The Diamond Machine Company, Providence, R. I., write us:

"We have been having a large demand lately for our bicycle machinery to go to foreign countries. We have received a great many letters and cable orders for our Ball Case grinder, Frame Drill, Hub Drill, and regular grinding and polishing machinery."

A thousand tons of barbed wire have been shipped by Oliver Bros. & Co., of Pittsburg, for use in Weyler's trocha. The contract for it was made through the Spanish minister at Washington.

The total exports of machinery, from the United States, as officially reported for the year 1896, amounted to $25,769,790; for 1895, $18,062,267. For December, 1896, they were $2,654,394; for December, 1895, $2,249,841.

### THE IRON MARKET.

An improved sentiment is asserting itself and the undertone is strengthening, although the actual demand for most lines is yet slack and prices are weak.

In another line of trade, also, there is encouragement. Hardware papers report for New York a distinct betterment in business.

## Quotations.

NEW YORK, Saturday, March 1st

Iron—American pig, tidewater delivery:

| | |
|---|---|
| No. 1 foundry, Northern | $12 00 @ $12 50 |
| No. 2 foundry, Northern | 11 50 @ 11 75 |
| No. 2 plain, Northern | 10 75 @ 11 00 |
| Gray Forge | 10 50 @ 11 00 |
| No. 1 foundry, Southern | 11 50 @ 12 00 |
| No. 2 foundry, Southern | 10 75 @ 11 00 |
| No. 3 foundry, Southern | 10 25 @ 10 75 |
| No. 1 soft, Southern | 10 75 @ 11 00 |
| No. 2 soft, Southern | 10 50 @ 10 75 |
| Foundry forge, or No. 4 Southern | 10 25 @ 10 50 |

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.07½ @ 1.15c.; refined, 1.15 @ 1.25c. Store prices: Common, 1.40 @ 1.50c.; refined, 1.50 @ 1.60c.

Steel Hoops and Bands—Prices have been reduced .10c., and are now, for base sizes: Hoops, 1.27½c. in carloads, .15c. more in smaller quantities; bands, 1.17½c. in carloads, .15c. more in smaller quantities.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some brands perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 1.60 @ 1.65c.

Cold Rolled Steel Shafting—Base size, 2.60 @ 2.65c., in small lots, from store.

Copper—Carload lots, Lake Superior ingot, 12.00c.; electrolytic, 11½ @ 11⅝c.; casting copper, 11⅜c.

Pig Tin—For 5 and 10-ton lots, 13.60 @ 13.70c., f. o. b.

Pig Lead—In carload lots, 3.30 @ 3.35c., f. o. b.

Spelter—In carload lots, New York delivery, 4.05 @ 4.10c., f. o. b.

Antimony—Cookson's, 7¼ @ 7⅜c.; Hallett's, 6¾ @ 6⅞c.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 38 @ 40c.

# Manufactures.

Messrs. Taber Bros., of Tacoma, Wash., are erecting a new sawmill.

At Mott street, New York City, August Mietz will erect a factory.

Mr. C. H. Masland, of Philadelphia, Pa., will erect a five-story mill.

James Morgan will erect, on Pine street, Pascoag, R. I., a grist mill.

J. B. Ehrsam & Sons, of Enterprise, Kan., are erecting new machine shops.

The Bethlehem Iron Company is erecting an addition to its machine shop.

John Ellis & Co., of Warren, Pa., contemplate the erection of a refinery.

George Blome & Son Company, Baltimore, Md., are to erect a new factory.

The Phoenix Iron Works, of Phoenix, Ariz., will soon erect a new machine shop.

Thomas Breen is contemplating the erection of a machine shop at San Francisco, Cal.

The Pratt & Whitney Company, Hartford, Conn., is to erect an addition to its plant.

At Cincinnati, O., the sawmill of W. H. Halbrook has been entirely destroyed by fire.

The Rome Gas Light Company, Rome, N. Y., is contemplating the enlargement of its plant.

Salling & Hanson, of Grayling, Mich., are going to erect a woodenware factory at Gaylord.

The King, Gilbert & Warner Company, Pomeroy, O., are to put in a new blast furnace.

At Pittsburg, Pa., J. J. Hass has begun the erection of a shop for manufacturing purposes.

The plant of the Cleveland Wood Turning Company, Reading, Pa., has been destroyed by fire.

A. Weiskettel & Sons, of Baltimore, Md., are about to erect a new foundry and enameling works.

The National Foundry and Pipe Works, of Scottdale, Pa., are adding a new machine shop to their plant.

The Jackson Company, of Nashua, N. H., has decided to add extensive improvements to its cotton plant.

The foundry and machine shops of Coombe & Carthew, of Lambertville, Pa., were destroyed by fire lately.

The Blacklock Foundry Company, of South Pittsburg, Tenn., contemplate the erection of an addition to its plant.

The McConnell Manufacturing Company, of Hornellsville, N. Y., contemplate the erection of an addition to their plant.

The flouring mill of Frank Snyder, Burbank, O., was destroyed by fire recently. The mill will be rebuilt at once.

The Catonsville Light & Power Company, of Catonsville, Md., which was incorporated recently, will erect a plant in that town.

The dye works of John Dook, Jr., & Sons, Philadelphia, Pa., was recently destroyed by fire. Much of the machinery was damaged.

The Record Manufacturing Company, Conneaut, O., contemplate the erection of a tinware manufacturing plant at Port Dover, Ont.

At Chicago, Ill., the Staver Carriage Company has been formed. Incorporators: Wm. S. Shuler, Clinton D. Ellis and George A. Hay.

The Cohansey Glass Manufacturing Company, Bridgeton, N. J., is making arrangements to start up another hollow ware factory.

(Continued on page 39.)


The Pratt & Whitney Co. HARTFORD, CONN., U.S.A.

...MAKERS OF...

Fine Machine Tools.

Complete Plants furnished for Bicycle, Typewriter, Gun and Sewing Machine Makers. Gauges and Small Tools for all Machine Work. Drop Hammers and Trimming Presses. Forging and Trimming Dies for all classes of work.

*England*—BUCK & HICKMAN, 280 Whitechapel Road, London, E.
*France*—FENWICK FRERES & Co., 21 Rue Martel, Paris.
*Germany and Austria*—SCHUCHARDT & SCHUTTE, Berlin and Vienna.
*Chicago*—42 and 44 South Clinton St. *Boston*—281 Franklin St. *New York*—123 Liberty St.

FINE SCREW PLATES.

"Lightning" and "Green River."

Taps, Dies, Reamers, Tap Wrenches, Bolt Cutters, Drilling Machines, Punching Presses and other labor saving Tools. SEND FOR CATALOGUE.

WILEY & RUSSELL MFG. CO., GREENFIELD, MASS.

Agents in London, SELIG, SONNENTHAL & CO., 85 Queen Victoria St.

Gas and Fuel Analysis for Engineers.

A COMPEND FOR THOSE INTERESTED IN THE ECONOMICAL APPLICATION OF FUEL.

BY AUGUSTUS H. GILL, S.B., PH.D.,

12mo. Cloth, $1.25.

JOHN WILEY & SONS, 53 East Tenth Street, New York City.

CATALOGUE FREE.

4 POINTS!!!! Design! Workmanship! Material! Finish!

All these are comprised in the make-up of our lathes and are the four necessary points in the construction of a good tool. Add to these a FIFTH and a very important one, the price, which we make very low to prompt cash buyers, and you have the story. Our Catalogue will tell you all about our Lathes, Planers, Shapers, etc.

SEBASTIAN LATHE COMPANY, 117 and 119 Culvert Street, CINCINNATI, OHIO, U.S.A.

DYER & DRISCOLL, PATENT SOLICITORS, 36 WALL ST., N.Y.

Have done all my patent soliciting work, both for this and foreign countries, continously for the past fourteen years.

Thomas A. Edison

STAR LATHES

★★★

Foot Power Screw Cutting, Automatic Cross Feed, 9 and 12" Swing.

Send for Catalog B.

Seneca Falls Mfg. Co.
687 Water St., Seneca Falls, N.Y.

WE CLAIM THE FOLLOWING MERITS FOR JENKINS BROS.' VALVES.

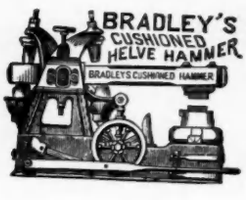
1. Manufacturered of the best Steam Metal.
2. No regrinding, therefore not constantly wearing out the Seat of the Valves.
3. Contain JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark.

JENKINS BROTHERS, New York, Philadelphia, Chicago, Boston.

EMERY WHEELS

NORTON Emery Wheel Co.
Worcester, Mass.

NEW COMPLETE ILLUSTRATED CATALOGUE FREE.




BRADLEY HAMMERS

THE BEST POWER HAMMERS ON EARTH.

22 sizes in Helve, Upright and Strap Styles.

Send for Printed Matter.

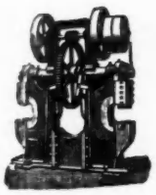
The Bradley Company
Syracuse, N. Y.

# The National Tube Works Co.

THE LARGEST MAKERS OF ALL SIZES AND KINDS OF SPECIAL WROUGHT MILD STEEL AND BEST WROUGHT IRON TUBULAR GOODS IN THE WORLD; CONTROL THE MANUFACTURE OF WROUGHT TUBULAR GOODS MADE OF A HIGH CLASS OF MILD STEEL FROM THE ORE TO THE FINISHED PRODUCT, AND UNQUALIFIEDLY RECOMMEND NATIONAL STEEL PIPE FOR ALL USES AS BETTER THAN ANY IRON PIPE MADE.

# POWER PRESSES

Punches and Shears,



REDUCING, FORMING AND FLARING ROLLS.

Power Hammers and Forging Machines.

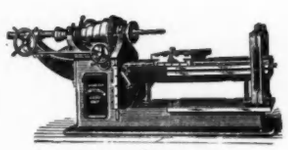
DIES AND SPECIAL MACHINERY.

GODFREY J. BREMER MACHINE CO.

KALAMAZOO, MICH., U. S. A.

Write for Catalogue "A" and Price List.

# DRILLS



HOR. BOR. AND DRILL. MACH.

FITCHBURG MACHINE WORKS

FITCHBURG, MASS., U.S.A.

METAL-WORKING MACHINERY.

CATALOG E.

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WORCESTER MACHINE SCREW CO

WORCESTER, MASS.

Manufacturers of Set, Cap & Machine Screws, Studs, etc.

## RARE BUSINESS OPPORTUNITY

FOR SALE—An old established Second-hand Mining Machinery Business and Machine Shops in Colorado. The largest in the State. $35,000 stock. Houses in Cripple Creek, Leadville and Denver, Col. The present owner wishes to retire or take in an active practical partner. In good hands the business will easily pay 100 per cent. a year. For particulars apply to

The Denver Mining Machinery Company,
Cripple Creek, Col.

## Columbia University
### in the City of New York.

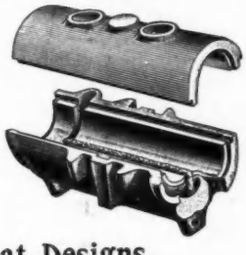
SCHOOL OF MINES,
SCHOOL OF CHEMISTRY,
SCHOOL OF ENGINEERING,
SCHOOL OF ARCHITECTURE,
SCHOOL OF PURE SCIENCE.

Four years' undergraduate courses and special facilities for graduate work in all departments. Circulars forwarded on application to the Secretary of the University.

# 6 MONTHS

Our hanger boxes will hold oil enough for *six months*. They have the proper kind of *fit* in the beginning, as the bearing is very smooth—regular *gun barrel finish*. That's why we call them

# SMOOTHBORE.



Neat Designs.
Correct Proportions.
Accurate Workmanship.

We make a great many, so we sell them

VERY CHEAP.

Send for Booklet and Discounts.

# P. PRYIBIL,

512-524 W. 41st St., NEW YORK.

Cables, "Pryibil, Newyork."
Use A.B.C. Code.


(*Continued from page 38.*)

At Portland, Me., the Surface Condenser Cleaning Company has been organized. President, James L. Rackliff; Treasurer, Hiram Knowlton.

At Rock Island, Ill., the Tropp-Darling Company has been incorporated. Incorporators: Swan Tropp, George A. Darling, J. H. Coleman and Andrew S. Hallberg.

The Gardner-Champlin Company has been incorporated at Chicago, Ill., to engage in the manufacture of machinery. Incorporators: Henry A. Gardner, Joseph Cummins and Hugo Dam.

Mr. H. M. Priest, W. Borden and others, of Steubenville, O., have purchased the factory of A. Northup & Co., South Side, Pittsburg, Pa., and will engage in the manufacture of sheet roofings.

At Omaha, Neb., the Sharples Company has been formed, and will engage in the manufacture of dairy and cheese factory machinery. The directors are P. W. Sharples, I. R. Comfort and Frank Crawford.

After investigating the cable, steam and compressed air systems of haulage, the Moore Run Coal Company, of Moore Run, Pa., has contracted with the General Electric Company for an electric haulage plant for its mine. The trackage to be covered is 3½ miles in length. The mining locomotives are to weight ten tons, and will haul forty loaded cars per trip, each car with its load weighing two and a half tons.

The Board of Directors of the Davis & Egan Machine Tool Company, of Cincinnati, O., held their annual meeting Saturday, Feb. 20th, and elected the following officers for the ensuing year: Charles Davis, president; W. H. Burtner, vice-president and treasurer; B. B. Quillan, secretary. They declared a dividend of 3 per cent. out of the earnings of the past three months. The company report having done a very heavy foreign business during the past six months, and to have added to their shop equipment some $34,000 worth of machinery. They have made many important alterations in their buildings, and are now erecting a large warehouse at the corner of Sixth street, Eggleston avenue and Lock street, in which to store all surplus tools as soon as a lot is finished, which will give them hundreds of square feet of floor space in their regular shops for manufacturing purposes, heretofore used as storage.

▲ ▲ ▲

## New Catalogs.

**There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.**

Coffin & Leighton, Syracuse, N. Y., send us a catalog containing illustrations and descriptions of machinist's tools, including rules, gages, protractors, etc. The catalog is 3½ x 6¼ inches.

We have received from Gould & Eberhardt, Newark, N. J., three catalogs, devoted respectively to the illustration of gear cutters, shapers and tool holders. They are all standard size, 3½ x 6 inches.

We have received from the Hilles & Jones Company, Wilmington, Del., catalog "N," which contains illustrations and descriptions of punching, shearing, bending and rolling machines. The catalog is large standard size, 9 x 12 inches.

We have received from the Ingersoll-Sergeant Drill Company, Havemeyer Building, New York, advance sheets of their No. 31 catalog, devoted exclusively to the illustration and description of air compressors. Half-tone engraving are given showing compressors of various types, driven by steam, belt and electricity. The catalog is standard size, 6 x 9 inches.

# BOOK DEPARTMENT.

This department has been opened for the convenience of our readers. The books here listed are recommended by our editors as being good; the date of publication, author, size and number of pages are given. We cannot send books for examination, charge them to book account or on C. O. D. orders. Cash must accompany order. We will pay postage to any part of the Universal Postal Union. No books exchanged.

**Address, AMERICAN MACHINIST PUBLISHING CO., 256 Broadway, New York.**

**Strength of Materials and Structures.** Sir J. Anderson, C. E. An excellent book for mechanics who wish to know something of the properties of materials out of which machines are constructed. It also treats on the strength of beams, girders, gearing columns, cranes, roof trusses, riveted structures, boilers, pipes, etc. Easily understood. 302 4½ x 6½-inch pages; 66 illustrations.....$1.50

**Practical Mechanics.** John Perry, M. E. One of the best books on the science of mechanics and machinery. Especially for non-mathematical readers. 256 4 x 6½-inch pages; 148 illustrations..$1.50

**The Mechanics of Machinery.** Alex. B. W. Kennedy. A standard and excellent authority on the problems involved in scientific machine design. Useful to all students of machinery, but requiring some knowledge of mathematics to be fully understood. 652 4½ x 7-inch pages; 374 illustrations.....$3.50

**Elementary Manual on Steam and the Steam Engine.** Andrew Jamieson. Intended especially for beginners in the science of steam engineering. Contains problems to be worked out by the student, and is a helpful book. 252 4½ x 7¼-inch pages; numerous illustrations.. .....$1.40

**Elementary Treatise on Mechanics.** William G. Peck. A good book on the theory of mechanics. Designed especially for students in schools but useful to others, especially those who have some knowledge of mathematics. 296 4½ x 7½ in. pages; 179 illustrations.....$1.50

**Heat a Mode of Motion.** Tyndall. The best known work on the nature and phenomena connected with heat, and one which no one who desires to understand the subject can afford to miss reading. Interesting and instructive. 591 5 x 7½ in. pages; 125 illustrations .....$2.50

**Pumping Machinery.** Wm. M. Barr. 1893. A practical hand book on construction and management of steam and other power pumping machines. Written by a man thoroughly conversant with the subject, and a book well adapted for the use of practical men. 447 5½ x 9 in. pages.....$5.00

**A Practical Treatise on Gearing.** Brown & Sharpe. 1896. Devoted to the shop side of the construction of gearing. Its source is sufficient recommendation. 156 6 x 9-in pages; 67 illustrations..$1.00

**A Manual of Marine Engineering.** A. E. Seaton. 1895. One of the best treatises on steam engine design. Devoted especially to marine engines, but large portions are equally adapted to stationary practice. Most of its rules are in algebraic signs and some knowledge of algebra is essential to its use. 585 5½ x 8½ in. pages; 144 illustrations..$6.00

**Boiler Making for Boiler Makers.** W. H. Ford. 1888. A practical treatise on the shop processes of boiler making. 233 4 x 5½ in. pages; 134 illustrations.....$1.00

**The Elements of Machine Design.** W. C. Unwin. The Standard all around treatise on machine design. Contains considerable algebra, but most of its matter is useful to one not understanding algebra.
Part I. General Machinery. 459 4½ x 6¾ in. pages; 304 illustrations.. .....$2.00
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